Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 09

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B.Tech.(ME)   (Sem.–6)
FLUID MACHINERY
Subject Code : ME-306
Paper ID : [A0821]

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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.**

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SECTION–A

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1. **Write briefly / True or False :**

   a) Write impulse momentum equation.

   b) The specific speed of single jet pelton wheel is x. What will be its specific speed if it has 3 similar nozzle.

   c) In case of Pelton turbine the axial thrust is zero. (*true or false*)

   d) Which turbine would you recommend for fluctuating and variable loads?

   e) If the number of fixed blades in Francis turbine is 2.0. How many moving blades will it have?

   f) What is accelerating head?

   g) Why is it not possible to deflect the jet through 180º in case of Pelton turbine?

   h) Mention two examples where torque convertor is used.

   i) Is there any limit to the length of suction pipe in centrifugal pump?

   j) Draw a curve showing head and discharge variation of a centrifugal pump.

SECTION–B

2. Show that the angle of showing of a vertical hinged plate of weight W is given by
$$\theta = \sin^{-1} \frac{\rho A V^2}{W}.$$

3. A jet of water having a velocity of 32 m/s strikes a series of curved radial vanes rotating at 250 *r.p.m.* The jet makes an angle of 20º with the tangent on the wheel at inlet and leaves with a velocity of 6 m/s at 132º to the tangent to the wheel at outlet. Water flows in radial inward direction. The outer and inner dia. of wheel are 1.2 m and 0.75 m. Find vane angles at inlet and exit.

4. Discuss the working proportion and design parameters for Francis turbines. Does a draft tube serve any useful purpose in Francis turbine? Discuss in detail.

5. A water turbine develops 1000 kW at 130 *r.p.m.* under a head of 14 m. Find max flow rate and specific speed for the turbine if overall η is 91%.

6. a) Draw and discuss operating characteristics of Francis turbines.

   b) Discuss the significance of unit speed and specific speed.

SECTION–C

7. a) Discuss the types of impellers and casings in case of centrifugal pumps. (4)

   b) Show that the pressure rise in an impeller of centrifugal pump is given by
   $$\frac{p_2 - p_1}{w} = \frac{1}{2g}\left[v_{f_1}^2 + u_2^2 - v_{f_2}^2 \cosec^2 \beta_2 \right]$$
   with usual notations. (6)

8. a) Explain the working of air lift pump with the help of a diagram. (5)

   b) A centrifugal pump 1.3 m dia delivers 3.5 m³/minute of water at tip speed of 10 m/s and flow velocity of 1.6 m/s. The outlet blade angle is 30º to the tangent at impeller periphery. Assume zero whirl at inlet and zero slip, find power delivered by impeller. (5)

9. The diameter and stroke of a single acting reciprocating pump are 75 mm and 150 mm. It takes supply of water from a sump 3 m below pump through 5 m long and 40 mm dia pipe. It delivers water to a tank 12 m above the pump through a pipe 15 m long and 30 mm dia. If separation occurs at 75 kN/m² below atmospheric pressure, find maximum speed at which it runs without separation. (10)