Dec.-22-0240

CE-609 (Hydraulic Machines)

B.Tech. 6th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. Explain the term negative slip as used in connection with the working of reciprocating pump. Why and when negative slip occurs? (10)

2. A jet of water moving at 12 m/s impinges on concave shaped vane to deflect the jet to 120 degree when stationary. If the vane is moving at 5 m/s, find the angle of jet so that there is no shock at inlet. Also compute the absolute velocity of the jet as exists both in magnitude and directions, and the workdone/second/kg of water. Assume that the vane is smooth. (10)

SECTION - B

3. Show that for centrifugal impeller, neglecting losses, the condition for maximum efficiency is given by

$$V_{f2} = \frac{u_2}{2}\tan\beta_2$$

where u_2 is the blade peripheral speed at outlet and, v_{f2} is the outlet velocity and β_2 is the blade angle at outlet measured with respect to the tangent. (10)

4. The piston of a double acting reciprocating pump has a diameter of 100 mm and a stroke of 250 mm. The pump has a vertical

suction pipe 5 m long and its diameter is 100 mm. The pump runs at 90 double stroke per minute and the motion is considered to be simple harmonic. Calculate the maximum permissible suction lift assuming that separation occurs at 2m of water absolute. Take atmospheric head as 10.2 m of water. How would this value change if crank connecting rod ratio is 1/7.5 and the piston motion is not considered to be simple harmonic? (10)

SECTION - C

5. Explain briefly the function of a draft tube and sketch some typical draft tubes. (10)

6. Determine the output from a Pelton wheel when the flow is reduced by 20 percent by means of a throttle valve before the nozzle. The wheel develops 410 kW at maximum efficiency before the flow reduction. The speed of wheel is the same before and after the reduction of flow and nozzle opening remain unchanged. (10)

SECTION - D

7. Describe the bore hole pump and its components in detail with neat sketch. (10)

8. A centrifugal pump running a 1000 rpm has a impeller 350 mm diameter. The outlet vane angle is 30°. The velocity of flow through the impeller is constant at 2.50 m/s. The static suction lift is 3.25 m. The following losses of head take place.

   Loss of head in the suction pipe = 0.75 m.

   Loss of head in the impeller = 0.60 m.

   Loss of head in the volute casing = 0.95 m.

   Find the pressure heads (a) at the inlet to the impeller (b) at the outlet to the impeller and (c) at inlet to the delivery pipe. Take the velocity in the suction and delivery pipe at 1.50 m/s. (10)

[P.T.O.]

SECTION - E

9. Answer the following questions in brief:

(a) Explain in brief about jet propulsion of ships.

(b) Explain the forces when flat plate is perpendicular to flow direction.

(c) Describe the uses of jets in real engineering applications.

(d) Differentiate between impulse and reaction turbine.

(e) Briefly state the significance of similarity parameters in hydraulic pumps.

(f) What are the uses of penstock?

(g) What is Cavitation? How can it be avoided in reaction turbine?

(h) How do you select the better turbine for different heads?

(i) Why are centrifugal pumps used sometimes in series and sometimes in parallel?

(j) Explain general working of submersible pumps.

(10×2=20)