15094

B. Tech 4th Semester Examination

Fluid Machinery (OS)

CE-4003

Time : 3 Hours   **Max. Marks : 100**

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, selecting one from each section A, B, C and D. Section E is compulsory.

SECTION - A

1. A jet of water having a velocity of 40m/s strikes a curved vane, which is moving with velocity of 20m/s. The jet makes an angle 30° with the direction of motion of vane at inlet and leaves at an angle of 90° to the motion of vane at outlet. Draw the velocity triangles at inlet & outlet. Also determine the vane angles at inlet and outlet so that water enters and leaves the vane without shock. (20)

2. A pelton wheel is having a mean bucket diameter of 1m and is running at 1000 r.p.m. The net head on pelton wheel is 700m. If the side clearance angle is 15° & discharge through the nozzle is 0.1 m^3/s, Find.

   (i)   Power available at the nozzle.

   (ii)   Hydraulic efficiency of the turbine. (20)

SECTION - A

3. The following data is given for Francis Turbine: Net Head=60m, Speed=700 r.p.m. Shaft Power=294.3 kW, η_0=84% η_h=93%, flow ratio=0.20, breadth ratio n=0.1, outer dia of runner=2×inner

diameter of runner. The thickness of vane occupy 5% of circumferential area of the runner, velocity of flow is constant at outlet. Determine:

(i)   Guide blade angle.

(ii)   Runner vane angles at inlet & outlet.

(iii) Diameter of runner at inlet and outlet.

(iv)   Width of wheel at inlet. (20)

4. (a) What do you understand by characteristics curves of a turbine? Explain important type of characteristics curves with neat sketch. (10)

   (b) What is draft tube? Explain its function and prove that pressure head at its entry point is less than atmospheric pressure. (10)

SECTION - C

5. Discuss briefly the function, construction and operation of Hydraulic Ram. Also obtain on expression for the efficiencies of the Hydraulic Ram. (20)

6. Hydraulic turbine is to develop 845 kW when running at 100 r.p.m. under a net head of 10m. Workout the maximum flow rate and specific speed for the turbine if the overall efficiency at the best operating point is 0.92%. In order to predict performance, a 1:10 scale model is tested under a head of 6m. What would be the speed, water consumption of model if it runs under the condition similar to the prototype. (20)

SECTION - D

7. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. under a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an

angle of 40º at outlet. If the outer diameter of impeller is 500mm and width at outlet is 50mm, determine.

(i)   Vane angle at outlet.

(ii)   Work done by impeller on water per second.

(iii)   Manometric efficiency.   (20)

8.   Derive an expression for the head lost due to friction in the delivery pipe of reciprocating pump with and without an air vessel.   (20)

SECTION - E

9.   (i)   Define specific speed of turbine.

(ii)   Define unit quantities.

(iii)   What is difference between impulse and reaction turbine?

(iv)   Define impulse-momentum principle.

(v)   What is degree of reaction?

(vi)   What is difference between Inward flow reaction and outward flow reaction turbine?

(vii) Define concept of negative slip in case of reciprocating pump.

(viii) What do you understand by 'Cavitation'?

(ix)   Define Buckingham Pi-theorem.

(x)   What is hydraulic efficiency of turbine?   (10×2=20)