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T. E. Sem V (CBSGS) Dec 2017 24/11/2017

AH-I (CIVIL)

Q.P.Code: 013329

(3 hours) Total marks: 80

N.B.: (1) Question no.1 is compulsory.

(2) Attempt any 3 questions out of the remaining 5 questions.

(3) Assume data wherever necessary and clearly mention the assumptions made.

(4) Draw neat figures as required.

Q1 Solve any four from the following 20

a Describe Cavitation phenomenon.

b Explain in detail Hydraulic similarity.

c Show that maximum efficiency of propulsion is 50% when the inlet orifices are at right angles to the direction of motion of ship.

d Explain Multistage Centrifugal Pump.

e Write a note on Hydraulic Intensifier.

Q2 a The pressure drop(ΔP) in a pipe depends upon the mean velocity of flow(v), length of the pipe(l), diameter of pipe(d), viscosity of fluid(μ), average height of roughness projection on inside pipe surface (k) and mass density of fluid (ρ) by using Buckingham's Π theorem, obtain a dimensionless expression for ΔP . 10

b. A stationary vane having an inlet angel of zero degree and an outlet angel of 25^0 receives water at velocity of 50m/s. Determine the components of force acting on it in the direction of the jet velocity and normal to it. Also find the resultant force in magnitude and direction per kg if flow. 10

If the vane stated above is moving with a velocity of 20m/s in the direction of jet, calculate the force components in the direction of vane velocity and across it, also the resultant force in magnitude and direction. Calculate the work done and power developed per kg of flow.

Q3 a A jet of water moving at 12m/s impinges on the concaved shape symmetrical vane to deflect the jet through 120^0. The vane is moving at 5m/s. Find (i) the angle of jet so that there is no shock at inlet (ii) The absolute velocity of the jet at exit both in magnitude and direction and (iii) the work done per sec per N of water. Assume that vane is smooth. 10

b 250 liters per sec of water is flowing in a pipe having a diameter of 300mm. If the pipe is bent by 135^0, find the magnitude and direction of the resultant force on the bend. The pressure of water flowing in the pipe is 390 kPa. **10**

Q4 a An inward flow reaction turbine is supplied 0.233 m^3/sec of water under a head of 11m. The wheel vanes are radial at inlet and the inlet diameter is twice the outlet diameter. The velocity of flow is constant and equal to 1.83m/sec. The wheel makes 370rpm. Determine (i) guide vane angle, (ii) inlet and outlet diameter of wheel, (iii) the width of the wheel at inlet and exit. Assume that discharge is radial and there are no losses in wheel. Take speed ratio = 0.7. Neglect the thickness of vanes. **10**

b A Kaplan turbine develops 8000HP under an effective head of 5m. Its speed ratio is 2 and flow ratio is 0.6 and the diameter of the boss = 0.35 times the external diameter of the runner. Mechanical efficiency of the turbine is 90%. Calculate the diameter of the runner, speed of runner and also its specific speed. **10**

Q5 a A pelton wheel is receiving water from a penstock with a gross head of 510m. 1/3 of the gross head is lost in friction in the penstock. The rate of flow to the nozzle fitted at the end of the penstock is 2.2m^3/s. The angle of deflection of jet is 165^0. Determine (i) The power given by water to the runner and (ii) Hydraulic efficiency of the pelton wheel. Take C_v (Coefficient of velocity) = 1 and speed ratio = 0.45: **10**

b A centrifugal pump discharges 7500 liters of water per minute against a total head of 25 m when running at 660 rpm. The outer diameter of the impeller is 600 mm and the ratio of outer to inner diameter is 2. The area of flow through the wheel is 0.06 m^2. The vanes are set back at an angle of 45^0. Water enters the wheel radially and without shock. Calculate (i) manometric efficiency and (ii) vane angle at inlet **10**

Q6 a A centrifugal pump impeller runs at 80 rpm and has outlet vane angle of 60^0. The velocity of flow is 2.5m/s throughout and diameter of the impeller at exit is twice that at inlet. If the manometric head is 20 m and the manometric efficiency is 75%. Determine (i) the diameter of impeller at the exit and (ii) inlet vane angle. **10**

b A conical draft tube having inlet and outlet diameters 1.2m and 1.8m discharges water at outlet with a velocity of 3m/s. The total length of draft tube is 7.2m and 1.44m of the length of draft tube is immersed in water. If the atmospheric pressure head is 10.3m of water and loss of head due to friction in the draft tube is equal to 0.2 x velocity head at outlet of the tube, determine (i) pressure head at inlet and (ii) efficiency of the draft tube. **10**

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