

T. E. Civil V - CBGS

Appl. Hyd - I

(3 Hours)

401 - 40

402 - 40

403 - 40

404 - 40

205 - 14

QP Code : 576900

28.11.2016

(190)

[Total Marks : 80

- N.B. :** (1) Question No. 1 is Compulsory.
(2) Answer **any three** out of remaining five questions.
(3) Assume suitable data wherever required and clearly state the same.
(4) Draw neat sketches wherever necessary.

1. Solve **any four** of the following .

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- State and derive moment of momentum equation.
- State the methods of selecting repeating variables.
- What is jet propulsion of ship? Explain with neat sketch
- Derive the equation of specific speed of turbine.
- What is cavitation? State the causes and effects of cavitation in centrifugal pump.
- Write short note on hydraulic ram.

2. (a) A 45° reducing bend connected in pipe line, the diameter at inlet & outlet of the bend being 400mm and 200 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet of the bend is 215.8kN/m². The rate of flow of water is 0.5 m³ /s. 10

(b) A twin jet unequal arm lawn sprinkler delivers a total discharge of 1.8 lps. Taking jet diameter as 1 cm and distance from axis of rotation to jet 20cm and 35cm and neglecting friction, find speed of sprinkler and torque to keep the sprinkler stationary if both jets are in opposite direction. 10

3. (a) Using Buckingham's π theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ where H-head causing 10

flow, D-diameter of the orifice, μ -coefficient of viscosity, ρ -mass density, g-acceleration due to gravity.

(b) (i) Water is flowing through a pipe of diameter 30cm at a velocity of 4 m/s. find the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.001 Ns/m² & 0.0025 Ns/m². The specific gravity of oil is 0.8. 10

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- (ii) A jet of water of diameter 50 mm moving with a velocity of 20 m/s strikes a fixed plate in such a way that the angle between the jet and the plate is 60° . Find the force exerted by the jet on the plate in the direction normal to the plate.
- 1 (a) A jet of water having a velocity of 30 m/s strikes a curved vane, which is moving with a velocity of 15 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 20° to the direction of motion of vane at outlet. Calculate (i) vane angles, so that the water enters & leaves the vane without shock. (ii) Work done per second per unit weight of water striking the vane per second. 10
- (b) A 137mm diameter jet of water issuing from a nozzle impinges on the buckets of a Pelton Wheel and the jet is deflected through an angle of 165° by the buckets. The head available at the nozzle is 400 m. Assuming coefficient of velocity as 0.97, speed ratio as 0.46 and reduction in relative velocity while passing through buckets as 15% find (i) The force exerted by the jet on the buckets in tangential direction. (ii) The power developed. 10
- (a) A Kaplan turbine working under a head of 20m develops 11000 kW shaft power. The outer diameter of the runner is 3 m and hub diameter 1.5 m. The guide blade angle at the extreme edge of the runner is: 35° . The hydraulic and overall efficiencies of the turbine are 86% and 82% respectively. If the velocity of whirl is zero at outlet, determine (i) Runner vane angles at inlet and outlet at the extreme edge of the runner and (ii) Speed of the turbine. 10
- (b) (i) A conical draft tube having diameter at the top as 2m and pressure head of 7 m of water (vacuum) discharges water at the outlet with a velocity of 1.2 m/s at the rate of $25 \text{ m}^3/\text{s}$. If atmospheric pressure head is 10.3m of water and losses between the inlet & outlet of the draft tube are negligible, find the length of draft tube immersed in water. Total length of tube is 5m. (ii) Draw layout of hydropower plant. 10

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- 6 (a) A centrifugal pump is running at 1000 rpm. The outlet Vane angle of the impeller is 30° and velocity of flow at outlet is 3 m/s. the pump is working against a total head, of 30m and the discharge through the pump is $0.3\text{m}^3/\text{s}$. If the manometric efficiency of the pump is 75% determine
- (i) The diameter of the impeller and
 - (ii) The width of the impeller at the outlet.
- (b) (i) Write short note on multistage centrifugal pump.
- (ii) Explain the hydraulic accumulator with neat sketch.

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