(vi) A rectangular weir 0.9m wide and 1.2m deep is discharging water from a vessel. The top is 0.6m below the water surface in the vessel. Calculate the discharge through the weir. Take $C_d = 0.6$.
(a) 0.7411m^3/s (b) 0.67 m^3/s
(c) 0.7754 m^3/s (d) 0.6743 m^3/s.

(vii) Reynolds number is defined as the ratio of
(a) Inertia force to viscous force
(b) Inertia force to surface tension force
(c) Inertia force to elastic force
(d) Inertia force to gravity force.

(viii) Friction loss through a pipe flow indicates
(a) loss of head due to static coefficient of friction
(b) loss of head due to dynamic coefficient of friction
(c) loss of head due to surface hardness
(d) loss of flow rate due to surface hardness of the pipe.

(ix) The error in discharge due to the error in the measurement of head over a rectangular notch is given by
(a) dQ/Q = (1/2)dH/H (b) dQ/Q = (3/2)dH/H
(c) dQ/Q = (5/2)dH/H (d) dQ/Q = (7/2)dH/H.

(x) Cippolett's weir is a trapezoidal weir having side slope of
(a) 1 : 4 (b) 1 : 5 (c) 2 : 3 (d) 1 : 2.

Group - B

2. (a) Derive the expression of Chezy's formulae for uniform steady flow.

(b) A trapezoidal channel 1.8 m wide at the bottom and having sides of slope 1:1 is laid on a slope of 0.0016. If the depth of the water is 1.5m. Find the rate of uniform flow Assume N=0.014

6 + 6 = 12

3. (a) A block of width 1.5 m, depth 1m and length 4 m is floating in water. If the density of block is 700 kg/m^3, find the volume of water displaced and the position of centre of buoyancy.

(b) Define most economical hydraulic section. Derive most economical hydraulic rectangular open channel.

6 + (1+5) = 12

Group - C

4. (a) Prove that the discharge through a triangular notch or weir is given by

$$Q_{act} = \frac{8}{15} C_d \sqrt{2g} \tan(\theta/2)\left[H^{5/2}\right]$$

(b) A rectangular notch 400 mm long is used for measuring a discharge of 30 litres/sec. An error of 1.5 mm was made, while measuring the head over the notch. Calculate the percentage error in the discharge assuming coefficient of discharge as 0.60.

8 + 4 = 12

5. (a) Derive the relations to calculate the loss of head due to (i) sudden enlargement and (ii) sudden contraction.

(b) The rate of flow of water through a horizontal pipe is $0.3m^3/sec$. The diameter of the pipe is suddenly enlarged from 250 mm to 500 mm. The pressure intensity in the smaller pipe is 13.734 N/cm^2. Determine (i) loss of head due to sudden enlargement (ii) pressure intensity in the large pipe.

8 + 4 = 12

Group - D

6. (a) Explain the term dynamic similarity. Differentiate between kinematic similarity and dynamic similarity.

(b) A 1:50 scale model of a spillway is to be tested in the laboratory. The velocity and discharge in the prototype are 10 m/s and 1000 m^3/s respectively. Find the corresponding velocity and discharge to be maintained in the model test.

(2+4) + 6 = 12

7. (a) Define critical, supercritical and subcritical flow.

(b) In a rectangular channel 2.4 m wide the discharge is $9.1m^3/s$. If a hydraulic jump occurs and the depth before the jump is 0.75 m. Find the height of the jump, energy head loss and power lost by energy dissipation.

3 + 9 = 12

Group - E

8. (a) Differentiate between impulse turbine and reaction turbine.

   (b) A pelton wheel has a mean bucket speed of 35 m/s with a jet of water flowing at the rate of $1m^3/s$ under a head of 270 m. The buckets deflect the jet through an angle of 170^0. Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Take C_v=0.98.

5 + 7 = 12

9. (a) The internal and external diameters of the impeller of the centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. The vane angles at inlet and outlet are 20^0 and 30^0 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.

   (b) Define priming and cavitation in case of a centrifugal pump.

8 + 4 = 12

2016

FLUID MECHANICS
(CIVL 2204)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: **10 × 1 = 10**

   (i) Hydraulic jump is used for
   (a) increasing the depth of flow (b) reducing the energy of flow
   (c) decreasing the velocity of flow (d) reducing turbulence.

   (ii) Specific energy head of a flowing fluid is given by
   (a) $y+v^2/2g$ (b) $z+y+ v^2/2g$
   (c) $y+ v^2/2g+p/\gamma g$ (d) $y+p/\gamma g$.

   (iii) In a similitude with gravity force, where equality of Froude number exists, the acceleration ratio a_r becomes
   (a) L_r^2 (b) $L_r^{5/2}$ (c) $L_r^{3/2}$ (d) 1.

   (iv) Kinematic similarity between model and prototype is the similarity of
   (a) shape (b) discharge
   (c) streamline pattern (d) forces

   (v) A rectangular open channel width 4.5 m is carrying a discharge of $100\ m^3/s$. The critical depth of channel is
   (a) 1.31 m (b) 2.16 m (c) 3.69 m (d) 7.09 m.