CS/B.TECH/CE/EVEN/SEM-4/CE-401/2018-19

Maulana Abul Kalam Azad University
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MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CE-401

FLUID MECHANICS

Time Allotted : 3 Hours   Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP – A
(Multiple Choice Type Questions)

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

    i) For a right-angled triangular notch, the expression of discharge is $Q = kH^{5/2}$, where Q is the rate of discharge and H is the head of water above the notch (consider coefficient of discharge $C_d = 0.6$).

    The magnitude of k is

    a) 1·147   b) 1·714

    c) 1·471   d) 1·417.

    ii) The side slope of the trapezoidal Cipolletti weir is x horizontal of y vertical. The value of x and y are respectively

    a) 2, 1   b) 1, 2

    c) 1, 4   d) 4, 1.

[Turn over

iii) The position of centre of pressure of a circular plate immersed somewhere in water (sp. *gr.* = 1·0) is 2 m below the free surface. What will be the position of centre of pressure of the same plate at same location immersed in oil of sp. *gr* = 0·8.

    a)   1·6 m

    b)   2·0 m

    c)   2·5 m

    d)   Insufficient data.

iv) A stone weighs 392·4 N in air and 196·2 N in water. The specific gravity of the stone is

    a)   1·5   b)   2·0

    c)   2·5   d)   3·0.

v) For a floating body the condition of stable equilibrium is

    a)   metacentre is above the centre of gravity of the body

    b)   centre of gravity is above the metacentre of the body

    c)   centre of gravity and metacentre act at same point

    d)   no conclusion can be drawn.

vi) Hydraulic jump is an example of

    a)   gradually varied uniform flow

    b)   gradually varied non-uniform flow

    c)   rapidly varied uniform flow

    d)   rapidly varied non-uniform flow.

vii) Pelton wheel is

    a)   impulse turbine

    b)   radial flow turbine

    c)   axial flow turbine

    d)   centrifugal pump.

viii) Two circular pipes are connected in series for water supply between two reservoirs situated at different elevations. The length and diameter of first pipe is L and d respectively. If the length of the second pipe is 32L then what will be its diameter if major frictional losses and friction factor are same for both pipes. http://www.makaut.com

    a) d b) $32d$

    c) $d/32$ d) $2d$.

ix) The metacentric height of a floating body is

    a)   the distance between metacentre and centre of buoyancy

    b)   the distance between the centre of buoyancy and centre of gravity

    c)   the distance between metacentre and centre of gravity

    d)   none of these.

x) Cavitation will take place if the pressure of the flowing fluid at any point is

    a)   more than vapour pressure of the fluid

    b)   equal to vapour pressure of the fluid

    c)   is less than vapour pressure of the fluid

    d)   none of these.

xi) To produce a high head by multistage centrifugal pump, the impellers are connected

    a)   in parallel

    b)   in series

    c)   in parallel and in series

    d)   none of these.

xii) The point, through which the weight is acting, is called

    a)   centre of pressure

    b)   centre of gravity

    c)   centre of buoyancy

    d)   none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. Write a short note on overall efficiency of a turbine. In case of turbine, how overall efficiency is related with hydraulic efficiency ? With a neat sketch show the main working parts of a centrifugal pump. $1\frac{1}{2} + \frac{1}{2} + 3$

3. Explain the working principle of Francis and Kaplan turbines.

4. The model of a boat is prepared to a scale 1 : 10 and towed in a water tunnel. If the speed of the boat is 20 m/sec., determine the towing speed of the model. Assume that the boat is subjected to only wave resistance.

5. Calculate the discharge through a pipe of diameter 300 mm when the difference of pressure head between two ends of pipe 450 m apart is 6·5 m of water. Take coefficient of friction, $f = 0.009$

6. Discuss brief about stability of floating body.

7. A centrifugal pump delivers water against a net head of 14·5 m and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300 mm and outlet width is 50 mm. Determine the discharge of the pump if manometric efficiency is 95%.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

8. a) Show that hydraulically most efficient trapezoidal section is half of a regular hexagon and its hydraulic radius is equal to half the depth of flow.

10

b) What is specific energy ? Draw the specific energy curve.   5

9. a) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 8 m/s and depth of flow is 0·5 m. The width of the channel is 6 m. Determine whether hydraulic jump will occur, and if so, find its height, loss of energy per kg of water and power loss is hydraulic jump.   10

b) State the working principle of a Pelton wheel.   5

10. a) The force exerted by a flowing fluid on a stationary body depends upon length (L) of the body, velocity (V) of the fluid, density (ρ) of fluid, viscosity (μ) of fluid, and acceleration (g) due to gravity. Using Buckingham's π theorem show that the expression of force $F = \rho L^2 V^2 \phi \left(\dfrac{\mu}{\rho VL}, \dfrac{Lg}{V^2} \right)$. 10

b) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litres/s. http://www.makaut.com 5

11. a) An oil of specific gravity 0·9 and viscosity 0·06 Poise is flowing through a pipe of diameter 200 mm at the rate of 60 lit/s. Find the head loss due to friction for a 500 m length of pipe. Also compute the power lost due to friction. 10

b) Define water hammer in pipes and Cavitation in pumps. 5

12. a) Write a short note on centrifugal pumps.   5

b) Find the discharge through a rectangular channel of width 2 m, having a bed slope of 4 in 8000. The depth of flow is 1·5 m and take Manning's coefficient, $N = 0·012$.   5

c) Write a short note on Hydraulic Ram.   5

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