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Question Paper Code: 44105

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Civil Engineering

14UCE405- APPLIED HYDRAULIC ENGINEERING

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Boundary layer thickness (δ) is the distance from the surface of the solid body in the direction perpendicular to flow, where the velocity of fluid is equal to

   (a) Free-stream velocity (b) 0.9 times the free stream velocity
   (c) 0.99 times the free stream velocity (d) None of these

2. L_1, L_2, L_3 are the length of three pipes connected in series. If d_1, d_2, and d_3 are their diameters, then the equivalent size of the pipe is given by h

   (a) $\frac{L}{d^5} = \frac{L_1}{d_1^5} + \frac{L_2}{d_2^5} + \frac{L_3}{d_3^5}$ (b) $\frac{d^5}{L} = \frac{d_1^5}{L_1} + \frac{d_2^5}{L_2} + \frac{d_3^5}{L_3}$
   (c) $Ld^5=L_1d_1^5+ L_2d_2^5+ L_3d_3^5$ (d) None of these

3. A rectangular channel section will be most economical when the depth of flow and bottom width are in the ratio of

   (a) 1:4 (b) 1:1 (c) 1:2 (d) 2:1

4. The maximum discharge through a circular channel takes place when depth of flow is equal to

   (a) 0.95 times the diameter (b) 0.3 times the diameter
   (c) 0.81 times the diameter (d) 0.5 times the diameter

5. The maximum increase in water level due to obstruction in the path of flow of water is called as

(a) hydraulic jump (b) gradually varied flow
(c) affux (d) surges

6. If the Froude number in open channel flow is more than 1.0, the flow is called

(a) critical flow (b) steaming flow
(c) shooting flow (d) none of the above

7. Turbines are used to generate

(a) velocity (b) head (c) discharge (d) power

8. Example for reaction turbine is

(a) Pelton turbine (b) pump
(c) gear pump (d) Francis turbine

9. The vertical height of the centre line of the centrifugal pump from the water surface in the pump is called as

(a) Suction head (b) Delivery head
(c) Manometric head (d) Static head

10. During suction stroke of a reciprocating pump, the separation may takes place

(a) at the end of suction stroke (b) in the middle of suction stroke
(c) in the beginning of suction stroke (d) none of the above

PART - B (5 x 2 = 10 Marks)

11. Define boundary layer thickness.

12. Define the term most economical section.

13. What are the types of flow profile?

14. How will you classify the Turbines?

15. Define Slip.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Derive the expression for Darcy weisbach equation. (10)

(ii) Calculate the discharge through a pipe of diameter 200*mm* when the difference of pressure head between the two ends of a pipe 500*m* apart is 4m of water. Take the value of 'f'=0.009 in the formula $h_f = \frac{4fLV^2}{2gd}$. (6)

Or

(b) The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300m, 170m and 210m and of diameters 300mm, 200mm and 400mm respectively, is 12m. Determine the rate of flow of water if co-efficient of friction are .005, .0052 and .0048 respectively, considering (i) minor loss (ii) neglecting minor loss. (16)

17. (a) A concrete lined circular channel of diameter 3*m* has a bed slope of 1 in 500. Work out the velocity and flow rate for the conditions of (i) maximum velocity and (ii) maximum discharge. Assume Chezy's *C*=50. (16)

Or

(b) (i) The discharge of water through a rectangular channel of width 8*m*, is 15m^3/s when depth of flow of water is 1.2*m*. Calculate

(1) Specific energy of the flowing water

(2) Critical depth and critical velocity

(3) Value of minimum specific energy. (10)

(ii) The specific energy for a 3*m* wide channel is to be 3 *kg-m/kg*. What would be the maximum possible discharge? (6)

18. (a) State and discuss the assumptions made in the derivation of the dynamic equation for GVF. Starting from first principle, derive equation for the slope of the water surface in GVF with respect to (i) Channel bed, (ii) Horizontal. (16)

Or

(b) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 6 *m/s* and depth of flow is 0.4 *m*. The width of the channel is 8 *m*, determine whether hydraulic jump will occur or not, and if so find its height, loss of energy per *kg* of water. Find also the depth of flow after the jump and power lost during the jump. (16)

19. (a) A Pelton wheel is to be designed for a head of 60*m* when running at 200*rpm*. The Pelton wheel develops 95.6475*kW* shaft power. The velocity of the buckets is equal to 0.45 times the velocity of the jet, overall efficiency is equal to 0.85 and coefficient of velocity is equal to 0.98. (16)

Or

(b) The external and internal diameters of an inward flow reaction turbine are 1.20 *m* and 0.6 *m* respectively. The head is 22 *m*, velocity of flow is constant and equals to 2.5 *m/s*. Guide blade angle is 10^0 and runner vanes are radial at inlet. If the discharge at outlet is radial, determine

(i) The speed of the turbine (ii) Vane angle at outlet

(iii) Hydraulic efficiency. (16)

20. (a) A single acting reciprocating pump discharges 4.5 liters per second with cylinder bore diameter 200mm and stroke length 300mm. The pump runs at 350rpm and lifts water through a height of 25m. The delivery pipe is 30m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. Also determine the percentage slip. (16)

Or

(b) A centrifugal pump delivers water against a net head of 14.5m and a design speed of 1000 rpm. The vanes are curved back to an angle of 30^0 with the periphery. The impeller diameter is 300mm and outlet width is 50mm. Determine the discharge of the pump if manometric efficiency is 95%. (16)