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Question Paper Code: 44105

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

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. In open channel, the specific energy is
 - (a) Energy per unit discharge
 - (b) Total Energy measured below the datum
 - (c) $h + V^2/2g$
 - (d) Loss of energy
2. A open channel flow is one in which
 - (a) The boundaries are closed at the top
 - (b) The liquid flowing with free surface
 - (c) Flow does not take place
 - (d) Steady flow take place
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) afflux (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. The rotating part of the centrifugal pump is
- (a) Impeller (b) Casing (c) Suction pipe (d) Delivery pipe

PART - B (5 x 2 = 10 Marks)

11. What is Friction factor?
12. What are the types of Flow?
13. Give the assumptions of Gradually Varied Flow.
14. How will you classify the Turbines?
15. Define Slip.

PART - C (5 x 16 = 80 Marks)

16. (a) Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = 2(y/\delta) - (y/\delta)^2$. (16)

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 horizontal pipe of diameter 500mm is suddenly contracted to a diameter of 250mm. the pressure intensities in the large and the smaller pipe is given as 13.734N/cm^2 and 11.772N/cm^2 respectively. Find the loss of head due to contraction if $C_c=0.62$. Also determine the rate of flow of water. (16)

Or

- (b) (i) The discharge of water through a rectangular channel of width 8m, is $15\text{m}^3/\text{s}$ when depth of flow of water is 1.2m. 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 3m wide channel is to be 3 kg-m/kg. What would be the maximum possible discharge? (6)

18. (a) (i) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 6m/s and depth of flow is 0.4m. The width of the channel is 8m. Determine whether a hydraulic jump will occur, and if so, find its height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump. (10)
- (ii) Derive the expression for depth of hydraulic jump in terms of upstream froude number. (6)

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 60m when running at 200rpm . The Pelton wheel develops 95.6475kW 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) An impulse wheel has a mean bucket speed of 10m/s with a jet of water flowing at the rate of $10 \text{ m}^3/\text{sec}$ under a head of 50m . The bucket deflects the jet through an angle of 165° . Calculate the work done, power given by water to the runner and the hydraulic efficiency of the turbine. Assume Coefficient of velocity as 0.99 . (16)

20. (a) The length and diameter of a suction pipe of a single acting reciprocating pump are 5m and 10cm respectively. The pump has a plunger of diameter 15cm and a stroke length of 35cm . The centre of the pump is 3m above the water surface in the pump. The atmospheric pressure head is 10.3m of water and pump is running at 35 r.p.m. determine:

(i) Pressure head due to acceleration at the beginning of the suction stroke

(ii) maximum pressure head due to acceleration, and

(iii) Pressure head in the cylinder at the beginning and at the end of the stroke. (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° 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)