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Question Paper Code: 44105

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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. If the Reynolds number is more than 5×10^5 , the boundary layer is called as
 - (a) Laminar boundary layer
 - (b) Turbulent Boundary layer
 - (c) Laminar sub layer
 - (d) Turbulent sub layer
2. While using Darcy-Weisbach equation for estimating head loss in a pipe flow, the friction factor was misjudged by +20% then, the error in estimating discharge is
 - (a) +10%
 - (b) +40%
 - (c) -40%
 - (d) -10%
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. In an open channel flow the discharge corresponding to the critical depth is
 - (a) Maximum
 - (b) Minimum
 - (c) Zero
 - (d) Average
5. Which of the following is the correct representation of the sequence of surface profiles if the channel slope changes from mild to steep?
 - (a) M_1, S_1
 - (b) M_3, S_2
 - (c) M_2, S_3
 - (d) M_2, S_2

6. In gradually varied flow, if dy/dx is positive then dE/dx will be
- (a) Always zero (b) Positive if $y > y_c$
(c) Negative if $y > y_c$ (d) Always negative
7. Cavitation in turbine causes
- (a) Damage to blades (b) Noise and vibrations
(c) Fall in efficiency (d) All of the above
8. The specific speed of a Francis turbine is in the range of
- (a) 10 to 35 (b) 35 to 60 (c) 60 to 140 (d) 3000 to 1200
9. The valve provided in a suction pipe is called
- (a) Float valve (b) Gate valve (c) Foot valve (d) Two-way valve
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. Distinguish between the pipes in series and in parallel.
12. What is the purpose of providing bed slope in channel?
13. State the assumptions involved in the analysis 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, energy thickness and Shape factor for the velocity distribution in the boundary layer given by
- $$u/U = 2(y/\delta) - (y/\delta)^2 \quad (16)$$

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) Water flows at rate of 20cumecs in a rectangular channel 14m wide at a velocity of 1.8m/s. Determine (a) the specific energy of the flowing water, (b)critical velocity and minimum specific energy corresponding to this discharge, (c) the Froude number and state whether the flow is subcritical or super critical. (16)

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) (i) Derive an expression for the length of the backwater. (8)
(ii) Define Hydraulic Jump. Explain its types with neat sketches. (8)

19. (a) (i) A Kaplan turbine is to be designed to develop 9000 kW. The net available head is 5.6m. The speed ratio is 2.09 and the flow ratio is 0.68. The overall Efficiency is 86% and the diameter of the boss is one-third the diameter of the runner. Determine the diameter of the runner, speed and specific speed of the turbine. (8)
(ii) What are the main components of Kaplan turbine? Explain with a neat sketches. (8)

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) 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) With a neat sketch, explain the principle and working of a centrifugal pump. (16)
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