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Question Paper Code: 41145

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

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)

- The separation of boundary takes place in case of
 - negative pressure gradient
 - positive pressure gradient
 - zero pressure gradient
 - none of the above
- The square root of the ratio of inertia force to gravity force is called
 - Reynold number
 - Froude number
 - Mach number
 - Euler number
- The discharge through a rectangular channel is maximum when
 - $m=d/3$
 - $m=d/2$
 - $m=2d$
 - $m=3d/2$
- The discharge through a trapezoidal channel is maximum when
 - half of top width = sloping side
 - top width = half of sloping side
 - top width = 1.5*sloping side
 - none of the above

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. If the head on the turbine is more than 300m, the type of turbine used should be
- (a) Kaplan (b) Francis (c) Pelton (d) Propeller
8. For low head and high discharge, the suitable turbine is
- (a) Pelton (b) Francis (c) Kaplan (d) none of these
9. Specific speed of a pump is the speed at which a pump runs when
- (a) head developed is unity and discharge is one cubic metre
(b) head developed is unity and shaft horse power is also unity
(c) discharge is one cubic metre and shaft horse power is unity
(d) none of the above
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. What are the types of turbine according to direction of flow through runner?
15. What is the purpose of an air vessel fitted in the pump?

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 0.005 , 0.0052 and 0.0048 respectively, considering (i) minor losses also (ii) neglecting minor losses. (16)
17. (a) A concrete lined circular channel of diameter $3m$ 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 $8m$, is $15m^3/s$ 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 $3 kg\cdot m/kg$. 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) Determine the length of the back water curve caused by an afflux of $2m$ in a rectangular channel of width $40m$ and depth $2.5m$. The slope of the bed is given as 1 in 11,000. Take Manning's $N=0.03$. (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) (i) A turbine is to operate under a head of $25m$ at $200rpm$. The discharge is 9 cumec . If the efficiency is 90% , determine the performance of the turbine under a head of $20m$. (6)
- (ii) A Kaplan turbine runner is to be designed to develop 9100 kW . The net available head is $5.6m$. If the speed ratio = 2.09 , flow ratio = 0.68 , overall efficiency 86% and the diameter of the boss is $1/3$ the diameter of the runner. Find the diameter of the runner, its speed and the specific speed of the turbine. (10)

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 three stage centrifugal pump has impellers $40cm$ in diameter and $2cm$ wide at outlet. The vanes are curved back at the outlet at 45° and reduce the circumferential area by 10% . The manometric efficiency is 90% and the overall efficiency is 80% . Determine the head generated by the pump when running at $1000r.p.m$, delivering 50 litres per second. What should be the shaft horse power? (16)