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Question Paper Code: 41415

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

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. Manning's formula is used to find

   (a) velocity (b) head (c) pressure (d) current

4. One of the condition for best rectangular section is

   (a) $d = b/2$ (b) $b = 4d$ (c) $v = 3$ (d) $R = d$

5. The condition for formation of hydraulic jump is

   (a) Specific energy is maximum
   (b) Specific energy is minimum
   (c) Specific energy is zero
   (d) Initial Froude's number is more than one

6. Back water curve is one in which depth of flow

   (a) decreases in the direction flow (b) increases in the direction flow
   (c) becomes zero (d) is 5 meters

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. Pump is used to

   (a) lower water from a higher level
   (b) generate energy
   (c) lift water from lower level to higher level
   (d) heat the water

10. Slip is the difference between

    (a) head and velocity
    (b) power and energy
    (c) actual discharge and theoretical discharge
    (d) head and discharge

PART - B (5 x 2 = 10 Marks)

11. Write about some minor losses.

12. Define critical depth.

13. State the conditions when hydraulic jump will form.

14. List the types of turbines.

15. What are the uses of air vessels?

PART - C (5 x 16 = 80 Marks)

16. (a) Find the displacement thickness, momentum thickness and energy thickness for a velocity distribution in the boundary given by $u/U = y/\delta$, where u is the velocity at a distance of y from the plate , $u = U$ at $y = \delta$, where δ is the boundary layer thickness. (16)

Or

(b) At a sudden enlargement of a water main from 240 *mm* to 480 *mm* diameter, the hydraulic gradient raises by 10 *mm*. Estimate the rate of flow flowing in the pipe. (16)

17. (a) (i) Derive the equations for

(1) Critical depth

(2) Critical velocity and

(3) Minimum specific energy in terms of critical depth. (10)

(ii) Find the critical depth and critical velocity of water flowing through a rectangular channel of width 5 *m*, when discharging 15 m^3/s. (6)

Or

(b) Trapezoidal channel with side slopes 1 to 1 has to be designed to carry 10 m^3/s at a velocity of 2 *m/s*, so that amount of lining of concrete for bed and sides is minimum. Calculate the area of lining required for one meter length of the channel. (16)

18. (a) A river 90 *m* wide and 3 *m* deep has a stable bed banks with a surface slope 1 *in* 2500. Estimate the length of back water curve produced by an afflux of 2 *m*. Assume Manning's $N = 0.035$. (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 develop 13250 *kW* under a net head of 800 *m*, while running at a speed of 600 *rpm*. If the coefficient of the jet is 0.97, speed ratio is 0.46 and jet diameter is 1/15 of wheel diameter. Assuming overall efficiency as 85%, calculate

(i) Diameter of the jet (ii) Diameter of the wheel

(iii) Discharge and (iv) Number of jets. (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) (i) Draw a neat sketch of an Reciprocating pump and explain the working principle of the pump. (10)

(ii) What is multistage pump? Explain them with neat sketches. (6)

Or

(b) The outer diameter of an impeller of a centrifugal pump is 400 *mm* and outlet width 50 *mm*, the pump is running at 800 *r.p.m* and is working against a total head of 15 *m*. The vanes angle at outlet is 40^0 and manometric efficiency is 75%. Determine:

(i) Velocity of flow at outlet

(ii)Velocity of water leaving the vane, and

(iii) Angle made by the absolute velocity at outlet with the direction of motion at outlet. (16)