KUMARAGURU
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Register Number:……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fourth Semester

CIVIL ENGINEERING

CEE108: Applied Hydraulics and Hydraulic Machinery

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If the Froude number in the open channel flow is equal to 1.0, the flow is called
   a) Critical flow b) Streaming flow
   c) Shooting flow d) None of the above
2. Chezy's formula is given as
   a) $V=i\sqrt{mC}$ b) $V=C\sqrt{mi}$
   c) $V=m\sqrt{Ci}$ d) None of the above
3. The discharge through a rectangular channel is maximum when
   a) m = d/3 b) m =d/2
   c) m =2d d) m =3d/2
4. The depth of flow at which specific energy is minimum is called
   a) Normal depth b) Critical depth
   c) Alternate depth d) None of the above
5. The hydraulic mean depth is given by _____ where P is wetted perimeter and A is area of cross section.
   a) P /A b) P^2/A
   c) A/P d) $\sqrt{A/P}$
6. Specific speed of turbine is defined as the speed of the turbine which ……
   a) Produces unit horse power at unit head b) Produces unit horse power at unit discharge
   c) Delivers unit discharge at unit head d) Delivers unit discharge at unit power

7. A pump is defined as the device which converts
   a) Hydraulic energy into mechanical energy
   b) Mechanical energy into hydraulic energy
   c) Kinetic energy into mechanical energy
   d) None of the above
8. Kaplan turbine is
   a) An impulse turbine
   b) A radial flow impulse turbine
   c) An axial flow reaction turbine
   d) A radial flow reaction turbine
9. Flow ratio is defined as the ratio of
   a) Velocity of flow at inlet to the velocity given by $\sqrt{2gh}$
   b) Velocity of runner at inlet to the velocity of flow at inlet
   c) Velocity of runner to the velocity given by$\sqrt{2gh}$
   d) None of the above
10. The flow in the open channel is laminar if the Renold number is
   a) 2000
   b) Less than 2000
   c) Less than 500
   d) None of the above

PART B (10 x 2 = 20 Marks)

11. Find the velocity flow in an open rectangular channel giving the cross section of 2m $\times$3m,take bed slope l in 200 and Manning's N as 0.015.
12. Differentiate between open channel flow and closed conduit flow.
13. Define steady and unsteady flow.
14. What do you mean by critical depth?
15. Expand GVF and RVF.
16. Designate length of backwater curve.
17. Distinguish between positive and negative surges in open channel.
18. Why the speed of a reciprocating pump without air vessels is not high?
19. Define slip, percentage slip and negative slip of a reciprocating pump.
20. Define the terms: a) Impact of jets, and b) Jet propulsion.

PART C (5 x 14 = 70 Marks)

21. a) A rectangular channel 4 m wide has depth of water 1.5 m. The slope of the bed of the channel is 1 in 1000 and value of Chezy's constant C = 55. It is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross-section, slope of the bed and roughness of the channel. Find the new dimensions of the channel and increase in discharge.

(OR)

b) Design a concrete lined channel to carry a discharge of 50 m^3/ sec at a slope of 1 in 4000. The side slope of the channel may be taken as 1: 1. The Manning's roughness co efficient for the lining is 0.014. Assume the permissible velocity in the section as 2.5 m/sec.

22. a) State and prove the conditions under which the trapezoidal section of an open channel will be most economical.

(OR)

b) A rectangular channel conveying a discharge of 30m^3/sec is 12 m wide with a bed slope of 1 in 6000 and N = 0.025. The depth of flow at a section is 1.50 m. Find how far upstream or downstream of this section the depth of flow will be 2 m. Use step method and take 2 steps.

23. a) A river 90m wide and 3m deep has a stable bed and vertical banks with a surface slope of 1 in 2500. Estimate the length of backwater curve produced by the afflux of 2m. Assume Manning's N = 0.035.

(OR)

b) A horizontal rectangular channel of 3m width and 2 m water depth conveys water at 18 m^3/sec. If the flow rate is suddenly reduced to 2/3 of its original value. Compute the magnitude and speed of the upstream surge. Assume that the front of surge is rectangular and friction in the channel is neglected.

24. a) The diameter and stroke of a single acting reciprocating pump are 200mm an400mm respectively, the pump runs at 60 rpm and lifts 12 liters of water per second through a height of 25m. The delivery pipe is 20m long and 150mm in diameter. Find i) theoretical power required to run the pump ii) percentage of slip and iii) acceleration head at the beginning and middle of the delivery stroke.

(OR)

b) A single acting reciprocating pump has a plunger of 80mm diameter and a stroke length of 150mm. It take its supply of water form a sump 3m below the pump through a pipe of 4.5m long and 30mm diameter. It delivers water to a tank 12m above the pump through a pipe 25mm diameter and 15m long. If separation occurs at 78.48KN/m^2 below atmospheric pressure, find the

maximum speed at which the pump may be operated without separation, assuming the plunger to have a simple harmonic action.

25. a) Explain the process of converting hydraulic energy into mechanical energy with a case study.

(OR)

b) The discharge of water through a rectangular channel of width 8m is $15m^3$/sec. When depth of flow of water is 1.2m. Calculate

1. Specific Energy
2. Critical Depth and Critical Velocity
3. Value of minimum Specific Energy

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