Register Number: ……

B.E. DEGREE EXAMINATIONS: APRIL/MAY 2012

Fourth Semester

CIVIL ENGINEERING

CEE108: Applied Hydraulics and Hydraulic Machinery

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. By using Chezy's formula, discharge is calculated as,

   (a) Q = AC$\sqrt{mi}$ (b) Q = Am$\sqrt{Ci}$ (c) Q = mC$\sqrt{Ai}$ (d) Q = iC$\sqrt{Am}$

2. 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

3. Specific energy of a flowing fluid per unit weight is equal to

   (a) $\frac{p}{w}+\frac{v^2}{2g}$ (b) $\frac{p}{w}+h$ (c) $\frac{v^2}{2g}+h$ (d) $\frac{p}{w}+\frac{v^2}{2g}+h$

4. If the Froude number in open channel flow is equal to 1.0, the flow is called

   (a) critical flow (b) sub-critical flow (c) super critical flow (d)shooting flow

5. Loss of energy due to the formation of hydraulic jump is equal to:

   (a) $\frac{(d_2-d_1)^3}{4d_1d_2}$ (b) $\frac{(d_1-d_2)^3}{4d_1d_2}$ (c) $\frac{4d_1d_2}{(d_2-d_1)^3}$ (d) $\frac{4d_1d_2}{(d_1-d_2)^3}$

6. Waves in open channels propagate with velocity equal to:

   (a) $\sqrt{2gy}$ (b) $\sqrt{gy}$ (c) $\sqrt{gy+V}$ (d) $\sqrt{y}+\sqrt{\frac{E}{\rho}}$

7. Efficiency of the jet of water having velocity V and striking a series of vertical plates moving with a velocity u, is maximum when

   (a) u = 2V (b) u=$\frac{V}{2}$ (c) u=$\frac{3V}{2}$ (d) u=$\frac{4V}{2}$

8. For high head and low discharge, the suitable turbine is

   (a) Pelton Wheel (b) Francis turbine (c) Kaplan turbine (d)Propeller turbine

9. The work done by impeller of a centrifugal pump on water per second per unit weight of water is given by,

   (a) $\frac{1}{g}V_{w1}u_1$ (b) $\frac{1}{g}V_{w2}u_2$ (c) $\frac{1}{g}(V_{w1}u_1-V_{w2}u_2)$ (d) $\frac{1}{g}(V_{w2}u_2-V_{w1}u_1)$

10. The work saved by fitting an air vessel to a double acting reciprocating pump is

(a) 39.2% (b) 84.8% (c) 48.8% (d) 92.3%

PART B (10 x 2 = 20 Marks)

11. Write the different types of regimes of flow.
12. Define steady and unsteady flow.
13. Define 'specific energy'.
14. What do you mean by 'alternate depths '?
15. Define 'Surge'.
16. What are the applications of hydraulic jump?
17. Write the broad classification of the turbines.
18. What are the purposes of draft tube in a turbine?
19. What is the principle of working of a centrifugal pump?
20. What is the negative slip? Also write the conditions for the negative slip?

PART C (5 x 14 = 70 Marks)

21. a) A flow of 100 litres per second flows down in a rectangular flume of width 0.6m having adjustable bottom slope. If Chezy's constant C is 56, find the bottom slope necessary for uniform flow with a depth of flow of 0.3m. Also find the conveyance K of the flume.

(OR)

b) Find the normal depth of flow in a 4m wide rectangular channel to discharge $12m^3/s$ of water if the bed slope is 0.0004. Take Manning's coefficient N = 0.014.

22. a) A channel of rectangular section is 4m wide with a bed slope of 0.0025, the depth of flow being 2m. Find the maximum height of a hump which can be provided so as not to change the upstream depth. If however, the upstream depth is to be raised to 2.15m what height of hump should be provided? Take Manning's coefficient N = 0.018.

(OR)

b) Water flows at the rate of $16m^3/s$ in a channel 10m wide at a velocity of 1.6m/s. Calculate the specific energy. Find also the critical depth, the critical velocity and the minimum value of the specific energy corresponding to this discharge in the channel.

23. a) Derive the Dynamic equation of gradually varied flow.

(OR)

b) A sluice spans a channel of rectangular section 18m wide and has an opening 0.75m deep and discharge $46.44m^3/s$ of water. If a hydraulic jump is formed on the

downstream side of the sluice, determine the probable height of the crest above the upper edge of the sluice. Find also the loss of energy head due to the jump.

24. a) A Pelton wheel is to be designed for the following specifications: Shaft power = 11,772kW; head = 380m; Speed = 750rpm; Overall efficiency = 86%; Jet diameter is not to exceed one-sixth of the wheel diameter. Determine: (i) The wheel diameter, (ii) The number of jets required and (iii) diameter of the jet. Take coefficient velocity K_{v1} = 0.985 and speed ratio K_{u1}=0.45.

(OR)

b) 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.

25. a) A centrifugal pump delivers water against a net head of 14.5metres and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300mm and outlet width 50mm. Determine the discharge of the pump if manometric efficiency is 95%.

(OR)

b) Find the maximum speed of a single acting reciprocating pump to avoid separation, which occurs at 2.3m of water (abs). The pump has a cylinder of diameter 10cm and a stroke length of 20cm. The pump draws water from a sump and delivers to a tank. The water level in the sump is 4m below the pump axis and in the tank the water level is 14m above the pump axis. The diameter and length of the suction pipe are 4cm and 6m while of delivery pipe the diameter and length are 3cm, 18m respectively. Take the atmospheric pressure head as 10.3m of water.

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