CBCS SCHEME

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15CV43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State and prove the Buckingham's π – Theorem. Why this theorem is considered superior over the Rayleigh's method. **(08 Marks)**

b. The discharge though a water is 1.5m^3/s find the discharge though the model of the weir if the horizontal dimension of the model is $\frac{1}{50}$ the horizontal dimension of the protype and vertical dimension of the model is $\frac{1}{10}$ the vertical dimension of the prototype. **(08 Marks)**

OR

2 a. Derive an expression for the Reynolds's number Froude number's **(08 Marks)**

b. A rectangular pontoon is 5m long 3m wide and 1.20m high. The depth of immersion of the pontoon is 0.80m in sea water. If the centre of gravity is 0.6m above the bottom of the pontoon, determine the meta centric height. The density for sea water is 1025 kg/m^3. **(08 Marks)**

Module-2

3 a. Derive an expression for the most economical trapezoidal section. **(08 Marks)**

b. The discharge of water through a rectangular channel of width 8m is 15m^3/s when the depth of flow of water is 1.2m, calculate

(i) Specific energy of the flowing water
(ii) Critical depth and critical velocity
(iii) Value of minimum specific energy. **(08 Marks)**

OR

4 a. What is specific energy curve? Draw it and derive expressions for critical depth and critical velocity. **(08 Marks)**

b. A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and the slopes of the bed is 1 in 1500. The area of the section is 40m^2. Find the dimensions of the section. If it is most economical. Determine the discharge of the most economical section if c = 50. **(08 Marks)**

Module-3

5 a. Explain the term standing wave. Derive an expression for the depth of standing wave in terms of the u/s Fronde number. **(08 Marks)**

b. Find the slope of the free water surface in a rectangular channel of width 20m having depth of flow 5m. The discharge through the channel is 50m^3/s. the bed of the channel is having a slope of 1 in 4000. Take the value of Chezy's constant c = 60. **(08 Marks)**

OR

6 a. Explain Back water curve and Afflux. **(04 Marks)**

b. A sluice gate discharge water in to a horizontal rectangular channel with a velocity of 6m/s and a 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. **(12 Marks)**

Module-4

7 a. Derive an expression for the impulse momentum equation. **(08 Marks)**

b. A Pelton wheel is working with a gross head of 500m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is $2.0m^3/s$. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency of the Pelton wheel.
Take speed ratio = 0.45 and $C_v = 1.0$. **(08 Marks)**

OR

8 a. Obtain an expression for the work done per second by water on the runner of a pelton wheel. Hence derive an expression for maximum efficiency of the pelton wheel. **(08 Marks)**

b. A jet of water of diameter 50mm, having a velocity of 20m/s strikes a curved vane which is moving with a velocity of 10m/s in the direction of the jet. The jet leaves the vane at an angle of 60° to the direction of motion of vane at out let. Determine :
   i) The force exerted by the jet on the vane in the direction of motion
   ii) Work done per second by the jet. **(08 Marks)**

Module-5

9 a. By means of a neat sketch, explain the Francis Turbine. **(08 Marks)**

b. Find the power required to derive a centrifugal pump which delivers $0.04m^3/s$ of water to a height of 20m through a 15cm diameter pipe and 100m long. The overall efficiency of the pump is 70% and coefficient of friction f = 0.15 in the formula $h_f = \frac{4flv^2}{2gd}$ **(08 Marks)**

OR

10 a. Define specific speed of a centrifugal pump. Derive on expression for the specific speed. **(08 Marks)**

b. The following data is given for a Francis Turbine, Net head H = 60m speed, N = 700rpm ; shaft power = 294.3kW ; $\eta_0 = 84\%$, $\eta_4 = 93\%$ flow ratio = 0.20 ; breadth ratio n = 0.1 ; outer diameter of the runner = 2 × inner diameter of runner. The thickness of vanes occupy 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine :
   i) Guide blade angle
   ii) Runner vane angles at inlet and outlet
   iii) Diameters of runner at inlet and outlet
   iv) Width of wheel at inlet. **(08 Marks)**

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