CBCS SCHEME

USN

15CV43

Fourth Semester B.E. Degree Examination, Dec. Man.2020
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data may be suitably assumed.

Module-1

1 a. Explain dimensional homogeneity with examples. **(05 Marks)**

b. State Buckingham's n-theorem and also describe Buckingham's Tr-theorem. **(05 Marks)**

c. Find the expression for the power P, developed by a pump when P depends upon the head H, the discharge Q and specific weight 'W' of the fluid. **(06 Marks)**

OR

2 a. What are the types of similarities to be established for complete similarity to exist between the model and its prototype? **(06 Marks)**

b. A 1:64 model is constructed of an open channel in concrete which has Manning's N = 0.014. Find the value of N for the model. **(05 Marks)**

c. Explain the term: Buoyancy, force and centre of Buoyancy and meta centre. **(05 Marks)**

Module_2

3 a. Discuss the various types of flow through channels. **(05 Marks)**

b. Derive Manning's equation for flow through open channel. **(05 Marks)**

c. An earthen channel with a base width 2m and side slope 1 horizontal to 2 vertical carries water with a depth of lm. The bed slope is I in 625. Calculate the discharge if mannings roughness is 0.03. Also calculate the average shear stress at the channel boundary. **(06 Marks)**

OR

4 a. Explain with a neat sketch of specific energy curve. Also derive an expression for critical depth, critical velocity and minimum specific energy. **(10 Marks)**

b. A rectangular channel which is laid on a bottom slope of 0.0064 is to carry 20 m^3/s of water. Determine the width of the channel when the flow is in critical condition. Take Manning's coefficient = 0.015. **(06 Marks)**

Module_3

5 a. Derive an expression for depth of hydraulic jump in terms of upstream Froude number. **(08 Marks)**

b. The depth of flow of water, at a certain section of a rectangular channel of 2m wide, is 0.3m. The discharge through the channel is I .5m^3/s. Determine whether a hydraulic pump will occur, and if so, fmd its height and loss of energy per Newton of water. **(08 Marks)**

OR

6 a. Derive GVF equation in the form $\frac{dh}{dx} = \frac{i_b - i_e}{(1 - Fr^2)}$, where $\frac{dh}{dx}$ = slope of free surface, i_b = bed slope, i_e = energy line slope, h = depth of flow and v = velocity of flow. State the assumptions made. **(09 Marks)**

b. Find the free surface slope in a rectangular channel of width 20m, having depth of flow 5m. The discharge through the channels is 50m^3/s. The longitudinal bed slope is 1 in 4000. Take C = 60. **(07 Marks)**

Module-4

7 a. Derive an expression for force exerted by a jet strikes the moving curved vane at the centre and also work done by the jet. **(09 Marks)**

b. A jet of water of diameter 75mm strikes a curved vane at its centre with a velocity of 20m/s. The curved vane is moving with a velocity of 8m/s in the direction of the jet. The jet is deflected through an angle of 165°. Assume the plate is smooth. Find: i) Force exerted on the plate in the direction of jet, ii) Power of the jet and iii) Efficiency of the jet. **(07 Marks)**

OR

8 a. Explain with a sketch the general layout of a hydro-electric power plant. **(05 Marks)**

b. Discuss the classification of turbines. **(05 Marks)**

c. Determine the power given by the jet of water to the runner of a Pelton wheel which is having tangential velocity as 20m/s. The net head at the turbine is 50m and discharge through the jet of water is 0.03 m^3/s. The side clearance angle is 15° and C_v = 0.98. **(06 Marks)**

Module-5

9 a. With a neat sketch explain working principle of Kaplan turbine and also mention the main components. **(08 Marks)**

b. A Kaplan turbine develops 24647.60kW power at an average head of 39m. Assuming the speed ratio of 2, flow ratio of 0.6, diameter of the bars equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine. **(08 Marks)**

OR

10 a. Obtain an expression for the work done by impeller of a centrifugal pump on water per` second per unit weight of water. **(06 Marks)**

b. Define the terms: suction head, delivery head, static head and manometric head. **(04 Marks)**

c. A centrifugal pump is to be discharge 0.118m^3/s at a speed of 1450 rpm against head of 25m. The impeller diameter is 250mm, its width at outlet is 50mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. **(06 Marks)**

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