CBCS SCHEME

USN | | | | | | | | | | 15CV43

Fourth Semester B.E. Degree Examination, July/August 2021

Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. State the advantages of dimensional analysis. **(03 Marks)**

b. Define the terms: (i) A model (ii) Prototype and state the difference between distorted models and undistorted models. **(06 Marks)**

c. Find the volume of water displaced and position of centre of Buoyancy for a Wooden block of width 2.5 m and depth 1.5 m, when it floats horizontally in water. The density of wooden block is 650 kg/m^3 and its length 6m. **(07 Marks)**

2 a. State the Buckingham, π theorem and mention the advantages. **(04 Marks)**

b. A model of spillway is made to test in the laboratory. The discharge and the velocity of flow over the model is measured as 2.5 m^3/s and 1.5 m/s respectively. Find the discharge and the velocity over the prototype, which is 50 time larger than its model. **(06 Marks)**

c. Define:
(i) Geometric similarity
(ii) Kinematic similarity
(iii) Buoyancy
(iv) Metacentre **(06 Marks)**

3 a. What do you mean by conveyance of a channel section? **(02 Marks)**

b. A flow of water of 100 ℓps flows down in a rectangular flume of width 600 mm and having adjustable bottom slope. If Chezy's C = 56, find the bottom slope necessary for uniform flow with a depth of flow of 300 mm. **(06 Marks)**

c. Define specific energy. Draw specific energy curve and obtain an expression for critical depth and critical velocity. **(08 Marks)**

4 a. What do you mean by most efficient channel section? **(02 Marks)**

b. A Trapezoidal channel with side slopes 1:1 has to be designed to convey 10 m^3/s at a velocity of 2 m/s. So that the amount of concrete lining for the bed and sides is the minimum. Calculate:
(i) Area of lining required for 1m length of the channel
(ii) Bed slope of the channel if, N = 0.015. **(06 Marks)**

c. Derive Chezy's equation for discharge through uniform flow in an open channel. **(08 Marks)**

5 a. Derive the dynamic equation governing Gradually Varied Flow (GVF). **(08 Marks)**

b. In Hydraulic Jump occurring in a rectangular horizontal channel, the discharge per unit width is 2.5 m^3/s/m and the depth before the jump is 0.25 m. Compute : (i) Sequent depth (ii) Energy loss **(08 Marks)**

6 a. Explain the classification of surface profiles in an open channel with neat sketches. **(10 Marks)**

b. A rectangular channel with a bottom width of 4.0 m and a bottom slope of 0.0008 has discharge of 1.5 m^3/s. In a GVF, in this channel, the depth at a certain location is found to be 0.30 m. Assuming n = 0.016, determine the type of GVF profile. **(06 Marks)**

7 a. State Impulse Momentum Principle and give the Impulse Momentum Equation. **(02 Marks)**

b. Prove that the workdone per second by a jet striking on a series of moving curved radial vane is ρ_{av_1} [$Vw_1u_1 \pm Vw_2u_2$] **(08 Marks)**

c. Two jets strike the buckets of a pelton wheel, which is having shaft power as 15450 KW. The diameter of each jet is 200 mm. If the net head of the turbine is 400 m. find the overall efficiency. Assume $C_V = 1$. **(06 Marks)**

8 a. Define (i) Absolute velocity (ii) Relative velocity, in the concept of velocity triangle. **(02 Marks)**

b. Draw a neat sketch of a layout of hydroelectric power plant and name the each component and different heads. **(06 Marks)**

c. A 15 cm diameter jet moving at 30 m/s impinges on a series of vanes moving at 15 m/s in the direction of the jet. The jet leaves the vanes at 60° with the direction of motion of the vanes, calculate:
(i) The force excerted by the jet in the direction of motion of the vanes.
(ii) Workdone by the jet/sec **(08 Marks)**

9 a. Define draft tube and mention its function. Draw the neat sketches of different types of draft tubes. **(06 Marks)**

b. What do you mean by minimum starting speed of a centrifugal pump? Give an expression for the same. **(04 Marks)**

c. A centrifugal pump delivers water against a net head of 10 m at 1000 rpm. The vanes are curved backwards and make an angle of 30° with the tangent at outer pheriphery. The impeller diameter is 30 cm and width is 5 cm at outlet. Determine the discharge if the manometric efficiency is 95%. **(06 Marks)**

10 a. What do you mean by multistage centrifugal pump? Distinguish between pumps in series and pumps in parallel. **(07 Marks)**

b. Define: (i) Unit head (ii) Unit discharge (iii) Unit power **(03 Marks)**

c. A Kaplan turbine develops 15000 KW power at a head of 30 m. The diameter of the boss is 0.35 times the diameter of the runner. Assuming a speed ratio of 2.0, a flow ratio of 0.65 and an overall efficiency of 90%. Calculate:
(i) Diameter of the runner
(ii) Rotational speed
(iii) Specific speed **(06 Marks)**

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