CBCS SCHEME

USN | | | | | | | | | | |

18CV43

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
Applied Hydraulics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Assume any missing data suitably.***

Module-1

1 a. What is dimensional analysis? Where is it applied? Which are the common methods of dimensional analysis? **(08 Marks)**

b. In a capillary tube of radius 'r', the capillary rise 'h' depends upon density of liquid ρ, acceleration due to gravity 'g', surface tension of liquid σ. Show by Buckingham π - method that $\frac{h}{r} = \phi\left[\frac{\sigma}{\rho g r^2}\right]$ **(12 Marks)**

OR

2 a. Distinguish between distorted and undistorted models with examples. **(08 Marks)**

b. The velocity and discharge observed in a model of a spillway were 3.25 m/s and 5.5 m^3/s respectively. If the velocity in the prototype is 26 m/s, find out the scale ratio of the model. Also find the discharge in the prototype. **(08 Marks)**

c. When do you say geometric similarity exists between the model and the prototype? **(04 Marks)**

Module-2

3 a. Define the most economical channel section. Derive an expression for the most economical triangular section. **(10 Marks)**

b. Determine the velocity and discharge for the condition of (i) Maximum velocity and (ii) Maximum discharge, for a circular channel of diameter, 2.5 m laid out to a slope of 1 in 1000. Take Chezy's constant, C = 50. **(10 Marks)**

OR

4 a. Explain specific energy. Elaborate the procedure to draw specific energy curve. Describe its salient features. **(12 Marks)**

b. Compute the maximum possible discharge in a 6.0 m wide channel having specific energy of 6.0 Nm/N. **(08 Marks)**

Module-3

5 a. Derive an expression for conjugate depths in case of hydraulic jump in a rectangular channel laid horizontal. **(10 Marks)**

b. Hydraulic jump occurs in a rectangular channel 0.75 m wide with a depth of flow of 0.20 m. If the Froude number is 3, determine critical depth, sequent depth, loss of head and power lost due to hydraulic jump. **(10 Marks)**

OR

6 a. What is gradually varied flow? Derive the dynamic equation for gradually varied flow. **(10 Marks)**

b. A rectangular channel of 15.0 m width and 4.0 m depth of flow, laid to a bed slope of 1:4000 has a discharge of 40 m^3/s. Taking Chezy's C = 50, find the slope of free water surface. **(10 Marks)**

Module-4

7 a. Obtain an expression for force exerted by a jet striking at the center of a moving symmetrical curved vane. And show that its maximum efficiency is limited to 16/27. **(10 Marks)**

b. A jet of water impinges on a curved plate with a velocity of 20 m/s making an angle of 20° with the direction of motion of vane at inlet and leaves at 130° to the direction of motion at outlet. The vane is moving with a velocity of 10 m/s. Compute:
(i) Vane angles, so that water enters and leaves without shock
(ii) Work done per second per unit weight of water **(10 Marks)**

OR

8 a. Draw the general layout of a hydro-electric power station and give in brief the function of each of the components. **(10 Marks)**

b. A single jet Pelton wheel develops 75 kW power when working under a head of 50 m and running at 250 rpm. Assuming an overall efficiency of 87%, coefficient of velocity of 0.98 and speed ratio as 0.48, determine:
(i) The jet diameter and wheel diameter
(ii) The size and number of buckets **(10 Marks)**

Module-5

9 a. Enumerate the advantages and disadvantages of reaction turbines over impulse turbines. **(06 Marks)**

b. What is a draft tube? Explain its functions in a reaction turbine. **(06 Marks)**

c. A Kaplan turbine develops 25,000 KW power at an average head of 50 m. Assuming speed ratio as 2.0, flow ratio as 0.6, diameter of boss equal to 0.35 times diameter of runner and overall efficiency of 90%, calculate the diameter, speed and specific speed of turbine. **(08 Marks)**

OR

10 a. Explain various efficiencies of centrifugal pumps. **(06 Marks)**

b. Derive an expression for minimum starting speed of a centrifugal pump. **(06 Marks)**

c. A centrifugal pump lifts water against a head of 40m. The suction and delivery pipes are each 150 mm in diameter. The head loss in the suction and delivery pipes are respectively 2.2 m and 7.5 m. The impeller is 400 mm in diameter and 25 mm wide at mouth. It revolves at 1200 rpm and the vane angle at outlet is 30°. If the manometric efficiency is 80%, compute the discharge. **(08 Marks)**

* * * * *