CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **17CV43**

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

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1   a.   Distinguish between :
   i)   Geometric and kinematic similarity
   ii)   Reynolds and Froude number
   iii)   Distorted and undistorted model.   **(06 Marks)**

     b.   State and explain Buckingham's π - theorem.   **(06 Marks)**

     c.   A 7.2m high and 15m long spillway discharges 94 m^3/sec of water under a head of 2m. If a 1 : 9 scale model of this spillway is to be constructed, determine model dimensions, headover the spillway model and model discharge. If model experiences a force of 7500N, determine force on the prototype.   **(08 Marks)**

OR

2   a.   Define : i) Center of Buoyancy ii) meta center. How they are used to identify the equilibrium condition of floating bodies.   **(06 Marks)**

     b.   A body of cross sectional area $2m^2$ and depth 5m has specific gravity 0.8. Determine the depth of immersion of the body.   **(04 Marks)**

     c.   A solid cylinder of dia 4.0m has a height of 4.0m. Find the meta-centric height of the cylinder. If the specific gravity of the material of cylinder = 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.   **(10 Marks)**

Module-2

3   a.   Distinguish between open channel flow and flow through pipes.   **(05 Marks)**

     b.   Derive the relationship between flow depth 'y' and radius 'r' in a circular open channel for maximum velocity for most economical section.   **(05 Marks)**

     c.   A canal of trapezoidal section has bed width of 8m and bed slope of 1 in 4000. If the depth of flow is 2.4m and side slopes of the channel are 1H to 3V, then determine the average velocity and the discharge carried by the channel. Also compute the average shear stress at the channel boundary. Take C = 56.   **(10 Marks)**

OR

4   a.   What is specific energy curve? Explain the salient features of the curve.   **(05 Marks)**

     b.   Compute the bed slope of trapezoidal section channel of bed width 6m, depth of water 3m and side slope of 3H to 4V, where the discharge through the channel is 30m^3/sec. Take C = 70.   **(08 Marks)**

     c.   A trapezoidal channel with side slope of 1 to 1 is to be designed to carry 10m^3/sec at a velocity of 2m/sec so that the amount of concrete lining for the bed and sides is the minimum. Compute the area of lining required for one meter length of channel.   **(07 Marks)**

17CV43

Module-3

5 a. Explain term standing wave. Discuss an expression for the depth of standing wave in terms of the upstream side Froude numbers. **(10 Marks)**

    b. Determine the length of the back water curve caused by an afflux of 2.0m in a rectangular channel of width 40m and depth 2.5m. The slope of the bed is given as 1 in 11000. Take Manning's N = 0.03. **(10 Marks)**

OR

6 a. With neat sketch, explain classification of channel bottom slopes and surface profiles. **(10 Marks)**

    b. A sluice gate discharge water into a horizontal rectangular channel with a velocity of 6m/sec and 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. **(10 Marks)**

Module-4

7 a. Show that the maximum efficiency of jet striking at the center of a symmetrical moving curved vane is $\left(\dfrac{16}{27}\right)$(60%). **(10 Marks)**

    b. Water available for a pelton wheel is 4 cumec and the total head from the reservoir to the nozzle is 250m. The turbine has two runners with two jet per runners. All the four jets have the same diameter. The pipe line is 3000m long. The efficiency of power transmission through the pipe line and the nozzle is 91% and efficiency of each runners is 90%. The velocity coefficient of each nozzle is 0.975 and co-efficient of friction '4f' for the pipe is 0.0045. Determine :
      i)   Power developed by turbine
      ii) The diameter of the jet
      iii) Diameter of the pipe line. **(10 Marks)**

OR

8 a. Draw a neat sketch of layout of hydroelectric power plant and explain the functions of each component. Also define different heads. **(10 Marks)**

    b. A jet water moving at 12m/sec impinges on vane shaped to deflect the jet through 120° when stationary. If the vane is moving at 5m/sec, find the angle of the jet so that there is no shock at inlet. What is the absolute velocity of the jet at exit in magnitude and direction and the work done per second per unit weight of water striking per second. Assume that vane is smooth. **(10 Marks)**

Module-5

9 a. Define draft tube. Explain its function. Draw neat sketch of types of draft tubes. **(06 Marks)**

    b. Derive on equation for specific speed of a turbine. **(06 Marks)**

    c. A Kaplan turbine develops 24647.6 KW power at an average head of 39 m. Assuming the speed ratio of 2, flow ratio of 0.6, diameter of boss equals to 0.35 times the diameter of runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine. **(08 Marks)**

OR

10 a. Derive on expression for the minimum starting speed for a centrifugal pump. **(06 Marks)**

    b. Define multistage centrifugal pump. With neat sketch, explain the multistage centrifugal pumps used for i) high heads   ii) high discharge. **(08 Marks)**

    c. A multistage centrifugal pump is required to lift 0.04m³/sec of water against a head of 700m of water. If the speed of the pump is 2500 rpm. Find the minimum number of stages required, if the specific speed is not less than 25. **(06 Marks)**