CBCS SCHEME

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

18CV43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
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. Explain the dimensional homogeneity of an equation with an example and state the uses of Dimensional analysis. **(06 Marks)**

b. Define the term Metacentre and Metacentric height. And A Rectangular pontoon 5m long , 3m wide and 1.2m height. The depth of immersion of pontoon is 0.8m in seawater. If the C.G is 0.6m above the bottom of the pontoon, determine the Metacentric height. Take density of seawater as 1025 kg/m^3. **(10 Marks)**

c. A Dam 15m long is to discharge water at the rate of 114m^3/s under a head of 3m. Design the model, if the supply available in the laboratory is 30 fps. **(04 Marks)**

OR

2 a. The Resisting torque 'T' against the motion of a shaft in a lubricated bearing depends on the viscosity 'μ', the rotational speed 'N' the diameter 'D' and the bearing pressure intensity 'ρ'. Show that $T = \mu N D^3 \phi\left(\frac{\rho}{\mu N}\right)$. Use Buckingham's π theorem method. **(10 Marks)**

b. Define the terms : i) Geometric similarity ii) Kinematic similarity
iii) Dynamic similarity. **(06 Marks)**

c. 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 1.5m/s respectively. Find the discharge and the velocity over the prototype, which is 50 times larger than its model. **(04 Marks)**

Module-2

3 a. Distinguish between Open channel flow and Pipe flow. **(06 Marks)**

b. Show that the length of one sloping side of a most economical trapezoidal channel is equal to half of the Top width. Also determine the hydraulic mean depth for this condition. **(08 Marks)**

c. A Trapezoidal channel has side slope 2V:3H. It is discharging water at the rate of 20 cumecs, with a bed slope 1 in 2000. Design the channel for its bestform.
Take Mannings n = 0.01. **(06 Marks)**

OR

4 a. Define Specific Energy and draw specific energy diagram. Obtain an expression for critical depth and critical velocity. **(10 Marks)**

b. A Rectangular channel 2.0m wide carries a discharge of 6m^3/s. Calculate the critical depth and specific energy at critical depth. **(04 Marks)**

c. Find the bed slope of Trapezoidal channel of bedwidth 6m, depth of water 3m and side slope of 3H:4V, when the discharge through the channel is 30m^3/s. Take C = 70. **(06 Marks)**

Module-3

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

b. Define the terms : i) Gradually Varied Flow (GVF) ii) Rapidly Varied Flow (RVF). **(04 Marks)**

c. In Hydraulic jump in a Rectangular horizontal channel , the discharge per unit width is $2.5m^3/s/m$ and the depth before the jump is 0.25m. Estimate i) The sequent depth ii) The Energy loss. **(06 Marks)**

OR

6 a. Obtain an expression for depth of Hydraulic jump in terms of Up streams Froude's Number and Sequent depth ratio's in terms of FN. **(08 Marks)**

b. Define the terms : i) Back water curve ii) Draw down curve iii) Afflux. **(06 Marks)**

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

Module-4

7 a. State Impulse Momentum principle and thus give the Impulse Momentum Equation. **(04 Marks)**

b. Explain the a neat sketch, the components and working of a Pelton Wheel (Impulse) turbine. **(10 Marks)**

c. A Jet of water 7.5cm in diameter having velocity of 20m/s strikes a series of the flat plates arranged around the periphery of a wheel. If the plates are moving at a velocity of 5m/s, compute the force excerted by the Jet on the plate, the work done / sec and the efficiency of the Jet. **(06 Marks)**

OR

8 a. Draw a neat sketch of a Layout of a Hydro Electric Power plant by indicating all the components and also mention the different types of heads and efficiencies. **(10 Marks)**

b. A Pelton wheel is to be designed for the following specifications :
Shaft power (S.P) = 11722 KN , Head = 380 mts , Speed = 750 rpm ,
$\eta_{overall} = 86\%$, Jet diameter is not to exceed $\frac{1}{6}$ of the wheel diameter. Determine
i) The wheel diameter ii) The number of Jets required and iii) Diameter of the Jet.
Take $C_V = 0.985$ and Speed ratio $\phi = 0.45$. **(10 Marks)**

Module-5

9 a. Explain the main parts and working principle of single stage centrifugal pump, with a neat sketch. **(08 Marks)**

b. What is Cavitation? What are the effects of Cavitation? **(04 Marks)**

c. A Kaplan turbine develops 15000 KW power at a head of 30m. 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 and iii) Specific speed. **(08 Marks)**

OR

10 a. What is Priming of a centrifugal pump and why it is necessary? **(04 Marks)**

b. What are the main uses of Draft tube? Describe with neat sketches any two types of draft tubes. **(08 Marks)**

c. Calculate the vane angle at Inlet of a centrifugal pump , impeller having 300mm diameter at inlet and 600mm diameter at outlet. The Impeller vanes are set back at an angle of 45^0 to the outer rim and the entry of the pump is radial. The pump runs at 1000 rpm and the velocity of flow through the impeller is constant at 3m/s. Also calculate the work done by unit weight of water and the velocity and direction of water at outlet. **(08 Marks)**

* * * * *