CBCS Scheme

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15CV43

Fourth Semester B.E. Degree Examination, June/July 2018
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is meant by Dimensional Homogeneity? Give example. **(06 Marks)**

b. The Frictional Torque (T) of a Disc of diameter (D) rotating at a speed (N) in a fluid of viscosity (μ) and density (ρ) in a turbulent flow using dimensional analysis prove $T = D^5N^2\rho\,\phi\left[\frac{\mu}{D^2N\rho}\right]$. **(10 Marks)**

OR

2 a. Explain three types of similarities in model analysis. **(06 Marks)**

b. A ship 300m long moves in a sea water, whose density is 1030 kg/m^3, A 1:100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30m/s and the resistance of the model is 60N. Determine the velocity of ship in sea water and also the resistance of the ship in sea water. The density of air is 1.24 kg/m^3. Take the kinematic viscosity of sea water and air as 0.012 stokes and 0.018 stokes respectively. **(10 Marks)**

Module-2

3 a. Explain classification of flow in open channel. **(06 Marks)**

b. Derive conditions for most economical rectangular channel. **(04 Marks)**

c. A trapezoidal channel has side slopes of 1H:2V and the slope of bed is 1 in 1500. The area of the section is 40m^2. Find the most economical dimensions of channel. Also determine the discharge of the channel. Take C = 50. **(06 Marks)**

OR

4 a. Explain with sketch the specific energy curve. **(06 Marks)**

b. The discharge of water through a rectangular channel of width 8m is 15 m^3/s, when depth of flow of water is 1.2m. Calculate:

i) Specific energy of flowing water.

ii) Critical depth and critical velocity.

iii) Value of minimum specific energy. **(10 Marks)**

Module-3

5 a. Derive equation of a hydraulic jump in a horizontal rectangular channel. **(10 Marks)**

b. A hydraulic jump forms at the downstream end of a spillway carrying 17.93 m^3/s discharge. If the depth before jump is 0.8m, determine the depth after jump and energy loss. **(06 Marks)**

OR

6 a. Explain following slope profiles: i) Critical slope ii) Mild slope iii) Steep slope also draw profiles of M1, M2 and M3. **(06 Marks)**

b. Derive expression for the length of backwater curve. **(10 Marks)**

Module-4

7 a. Derive expression for force and work done on a curved plate, which is moving in the direction of jet. **(06 Marks)**

b. A jet of water having a velocity of 40 m/s strikes a curved vane which is moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at angle of 90° to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vanes without shock. **(10 Marks)**

OR

8 a. Explain classification of Turbines. **(06 Marks)**

b. The Penstock supplies water from a reservoir to the pelton wheel with a gross head of 500m. One-third of gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of penstock is 2 m^3/s. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency take speed ratio as 0.45 and coefficient of velocity as 1. **(10 Marks)**

Module-5

9 a. Explain with a neat sketch the working of a inward flow reaction turbine (Francis turbine). **(06 Marks)**

b. A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6m. If the speed ratio is 2.09, flow ratio is 0.68, overall efficiency is 86% and the diameter of the boss is 1/3 × diameter of the runner. Find the diameter of the runner, its speed and specific speed of the turbine. **(10 Marks)**

OR

10 a. Explain components and working of a centrifugal pump. **(06 Marks)**

b. A centrifugal pump having outer diameter = 2 times the inner diameter and running at 1000 RPM works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500mm and width at outlet is 50mm, determine: i) Vane angle at inlet ii) Work done by impeller on water/sec iii) Manometric efficiency. **(10 Marks)**

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