Code: CE4T4

II B.Tech - II Semester – Regular Examinations - JUNE 2014

HYDRAULICS AND HYDRAULIC MACHINERY
(CIVIL ENGINEERING)

Duration: 3 hours   Marks: 5x14=70

Answer any FIVE questions.   All questions carry equal marks

1. a) Differentiate the following:
   (i) Uniform flow and non-uniform flow   2 M
   (ii) Laminar and turbulent flow   2 M
   (iii) Critical, sub critical and super critical flow in an open channel.   3 M

   b) A rectangular channel of width 4 m is having a bed slope of 1 in 1500. Find the maximum discharge through the channel. Take Chezy's constant C= 50.   7 M

2. a) What is specific energy curve? Draw specific energy curve and then derive expressions for critical depth.   7 M

   b) The discharge of water through a rectangular channel of width 6 m, is 18 m^3/s when depth of flow of water is 2 m.
   Calculate: (i) specific energy of the flowing water
                   (ii) critical depth and critical velocity and
                   (iii) value of minimum specific energy. 7 M

3. a) Distinguish between

          (i) Geometric and Kinematic similarity   3 M

          (ii) Reynold's and Froude's Number   2 M

          (iii) Distorted and undistorted model   2 M

   b) Explain the Buckingham's Π theorem of dimensional analysis.   7 M

4.   A jet of water of diameter 10 cm strikes a flat plate normally with a velocity of 15 m/s. The plate is moving with a velocity of 6 m/s in the direction of the jet and away from the jet. Find:

          (i) the force exerted by the jet on the plate

          (ii) work done by the jet on the plate per second. Also find the power and efficiency of the jet.   14 M

5. a) A pelton wheel turbine is having a mean runner diameter of 1.0 m and is running at 1000 rpm. The net head is 100 m. If the angle of the bucket at the outlet tip is 20° and discharge is 0.1 m³/sec, find the power available at the nozzle and hydraulic efficiency of the turbine.   7 M

   b) Sketch the layout of a Pelton wheel turbine showing the details of nozzle, buckets and wheel when the turbine axis is horizontal. How will you classify the turbines? 7 M

6. a) Define the terms 'unit power', 'unit speed' and 'unit discharge' with reference to a hydraulic turbine. State the significance of specific speed in the study of hydraulic machines.   7 M

b) A turbine is to operate under a head of 25m at 200 r.p.m. The discharge is 9m³/s. If the efficiency is 90 %, determine:
   (i) Specific speed of the machine
   (ii) power generation
   (iii) type of turbine.   7 M

7. a) With a neat sketch explain the working of centrifugal pump.   7 M

b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angle of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. 7 M

8. The load on a hydel plant varies from a minimum 10,000 KW to a maximum of 35,000 KW. Two turbo-generators of capacities 22,000 KW each have been installed. Calculate

    (i) Total installed capacity of the plant

    (ii) Plant factor

    (iii) Maximum demand

    (iv) Load factor and

    (v)   Utilization factor.   14 M