Code: 15A01510

R15

B.Tech III Year I Semester (R15) Regular Examinations November/December 2017
FLUID MECHANICS & HYDRAULIC MACHINES
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)
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1   Answer the following: (10 X 02 = 20 Marks)
- (a) Give the expression for Total Pressure on vertical plane surface & curved surface.
- (b) What is the working principle of manometers?
- (c) What are the assumptions of Bernoulli's theorem?
- (d) Derive the expression for one dimensional continuity equation.
- (e) What are the various causes of minor losses in pipes?
- (f) Derive an expression for velocity of flow using Pitot tube.
- (g) Define impact of jet.
- (h) What is a draft tube?
- (i) What is specific speed of a turbine and give its expression?
- (j) Define NPSH.

PART – B
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2   Find the magnitude and direction of the resultant force due to water acting on a roller gate of cylindrical form of 4.0 m diameter, when the gate is place on the dam in such a way that water is just going to spill. Take the length of the gate as 8 m.

OR

3   A fluid field is given by $V = x^2y\ i + y^2z\ j – (2\ xyz + z^2)k$. Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2, 1, 3).

UNIT – II

4   A main pipe divides into two parallel pipes which again forms as one pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively, while the length and diameter of second parallel pipe are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe, if the total flow in the main pipe is 3.0 m^3/s. The coefficient of friction for each parallel pipe is same and equal to 0.005.

OR

5   A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at the inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through the venturimeter. Take the C_d = 0.98.

UNIT – III

6   A jet of water 75 mm diameter having a velocity of 20 m/s, strikes normally a flat smooth plate. Determine the thrust on the plate: (i) If the plate is at rest. (b) If the plate is moving in the same direction as the jet with a velocity of 5 m/s. Also find the work done per second on the plate in each case and the efficiency of the jet when the plate is moving.

OR

7   Write short notes on:
- (a) Runoff river plants.
- (b) Valley dam plants.
- (c) Diversion canal plants.
- (d) High head diversion plants.

UNIT – IV

8   A pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at the rate of 0.7 m^3/s under a head of 30 m. If the buckets deflect the jet through an angle of 160^0, find the power and the efficiency of the turbine.

OR

9   (a)   The following data were obtained from tests on pelton wheel:

       (i) Head at the base of nozzle = 32 m

       (ii) Discharge of the nozzle = 0.18 m^3/s

       (iii) Area of the jet = 7500 mm^2

       (iv) Power available at the shaft = 44 kW

       (v) Mechanical efficiency = 94%.

     Calculate the power lost in: (i) In the nozzle. (ii) In the runner. (iii) In mechanical function.

  (b)   A turbine develops 7460 kW under a head of 24.7 m at 135 rpm. What is the specific speed? What would be normal speed and output under a head of 19.5 m?

UNIT – V

10   (a)   Define specific speed of centrifugal pump. Derive an expression.

   (b)   Briefly explain the characteristics of centrifugal pumps.

OR

11   A centrifugal pump is required to deliver 280 liters of water per second against a head of 16 m. If the vanes of the impeller are radial at outlet and the velocity of flow is constant equal to 2 m/s, find the proportions of the pump. Assume η_{man} = 80% and the ratio of breadth to diameter at outlet as 0.1. (K_u = 1.6).

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