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Code No: 07A52401 **R07** **Set No. 2**

III B.Tech I Semester Examinations,May 2011
FLUID MECHANICS AND HYDRAULIC MACHINERY
Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the expression for the force exerted by a jet of water on inclined fixed plate in the direction of jet.
   (b) A jet of water strikes with a velocity of 35m/s a flat plate inclined at 30^0 with the axis of the jet. If the cross-sectional area of the jet is $25cm^2$ determine.
      i. The force exerted by the jet on the plane
      ii. The components of the force in the direction normal to the jet.
      iii. The ratio in which the discharge gets divided after striking the plate. [8+8]

2. (a) By means of a neat sketch explain the governing mechanism of Francis turbine.
   (b) Define the terms:
      i. Speed ratio.
      ii. Flow ratio.
      iii. Jet ratio. [16]

3. (a) How will you classify the reciprocating pumps? With a neat sketch explain the principle and working of reciprocating pump.
   (b) A single acting reciprocating pump running at 30rpm delivers 0.02 m^3/s of water. The diameter of the piston is 250mm and stroke length 500mm determine:
      i. The theoretical discharge of the pump.
      ii. Co-efficient of discharge. [8+8]

4. A water turbine delivering 10MW power is to be tested with the help of a geometrically similar 1:8 model which runs at the same speed as the prototype.
   (a) Find the power developed by the model assuming the efficiency of the model and the prototype are equal .
   (b) Find the ratio of the heads and the ratio of mass flow rates between the prototype and the model. [16]

5. A 30cm × 15cm venturi meter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the Venturi meter is 30cm. The differential U-tube mercury manometer shows a gauge deflection of 25cm. Calculate:
   (a) The discharge of oil.

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(b) The pressure difference between the entrance section and throat section. Take the coefficient of meter as 0.98 and specific gravity of mercury as 13.6. [16]

6. In a fluid the velocity field is given by V= (3x+2y)i + (2z + 3x^2)j +(2t-3z)k. Determine:

   (a) The velocity components u, v, w at any point in the flow field.

   (b) The speed at point (1,1,1).

   (c) The speed at time t=2 sec. [16]

7. (a) Describe the U- tube Manometers with neat sketches.

   (b) The right limb of a simple U- tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp. gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.

8. (a) a) The following data related to a proposed hydro electric station: Available head = 28m, catchments area = 420 sq. km; rainfall = 140 cm/year; % of total rainfall utilized = 68

      i. Calculate the power developed, and,

      ii. Suggest suitable machines and specify the same.

   (b) Define mass curve?

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Code No: 07A52401 **R07** **Set No. 4**

III B.Tech I Semester Examinations,May 2011
FLUID MECHANICS AND HYDRAULIC MACHINERY
Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) How is the selection of pumps made? Give the operational difficulties commonly experienced in centrifugal pumps and their remedies.
   (b) What do you mean by characteristic curves of centrifugal pumps? What is the significance of characteristic curves? Draw the following characteristics curves for centrifugal pump: Head, Power and Efficiency versus discharge with constant head. [8+8]

2. (a) Explain the terms specific speed, unit speed and unit power as applied to hydraulic turbines.
   (b) Briefly explain the various considerations in the selection of a type of turbine for a hydraulic station, indicating also the conditions where a particular type of turbine is suitable. [8+8]

3. (a) Compare the hydro-power station with thermal power station.
   (b) write a detailed note on Hydropower development in India. [8+8]

4. 250 liters/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by $135^{\mathbf{0}}$, find the magnitude and direction of the resultant force on the bend. The pressure of the water flowing is 400 KN/m^2. Take specific weight of water as 9.81 KN/m^3. [16]

5. (a) What is Capillary. What is the significance of it?
   (b) Calculate the maximum capillary rise of water tube to be expected between two vertical clean glass plates spaced 1mm apart. If the water is replaced by mercury, what would be the maximum capillary depression of mercury in the same space? Assume appropriate values for the surface tension and angle of contact. [8+8]

6. Show that for a curved radial vane the work done per second is given by $\rho a \nu_1 (\nu w_1 u_1 \pm \nu w_2 u_2)$. [16]

7. (a) Explain clearly the following terms:
      i. Gross head.
      ii. Net head.
   (b) Design a Pelton wheel using the following data
   Power =735.5 KW, head =200m, speed = 300 rpm. Speed ratio =0.46 Cv= 0.98, efficiency =90%. [8+8]

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8. (a) Explain Venturi meter with a neat sketch.

   (b) A Venturi meter is installed in a pipe 400mm in diameter. The throat pipe diameter ratio is 1/3. Water flows through the installation. The pressure in the pipe line is 1.405kg/cm^2 and the vacuum in the throat is 37.5cm of mercury. If 4% of the differential head is lost between the gauges, find the flow in the pipe line. [8+8]

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Code No: 07A52401 **R07** **Set No. 1**

III B.Tech I Semester Examinations,May 2011
FLUID MECHANICS AND HYDRAULIC MACHINERY
Automobile Engineering

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Differentiate between:
   i. Force exerted by jet of water on fixed vertical plate and moving vertical plate.
   ii. Force exerted by jet on single curved moving plate and series of curving moving plate.

   (b) A 20mm diameter jet moving with a velocity of 20m/s strikes a flat vertical plate normally .Find the force exerted if the plate moves with a velocity of 5m/s in the direction of jet. Find also the work done and efficiency. [8+8]

2. (a) Define the term vapour pressure. How does it vary with temperature?

   (b) A soap bubble 50mm diameter has an internal pressure in excess of the outside pressure of 25 N/m^2. Calculate tension in the soap film. [8+8]

3. (a) Define Steady, Un-Steady, Uniform and Non-Uniform flows.

   (b) The diameter of a pipe at the section 1 and 2 are 15cm and 20cm respectively. Find the discharge through the pipe if velocity of water at section 1 is 4m/sec. Determine also the velocity at section2. [8+8]

4. A Pelton wheel generates 8000kw under a net head of 130m at a speed of 200rpm.Assuming the co-efficient of velocity for the nozzle 0.98, efficiency 87% speed ratio0.46 and jet diameter to wheel diameter ratio is 1/9,determine:

   (a) Discharge required.
   (b) Diameter of the wheel.
   (c) Diameter and number of jets required and .
   (d) Specific speed. Mechanical efficiency is 75%. [16]

5. (a) Derive expressions for discharge, work done, power and efficiency of Kaplan turbine?

   (b) State the advantages of
   i. Kaplan and Francis turbine.
   ii. Francis turbine and Pelton wheel? [8+8]

6. (a) What are the different types of Hydropower plants? Explain each.

   (b) What are the different components of hydro power plant? what are the purposes of providing them. [8+8]

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7. (a) Calculate the rate of flow of water through a pipe of diameter 300mm, when the difference of pressure head between the two ends of a pipe 400m apart is 5m of water. Take value of f =0.009.

   (b) The rate of flow of water through a horizontal pipe is $0.3m^3$/sec. The diameter of the pipe is suddenly enlarged from 250mm to 500mm. The pressure intensity in the smaller pipe is 13.73 N/cm^2. Determine:

      i. Loss of head due to sudden enlargement.
      ii. Pressure intensity in the large pipe.
      iii. Power loss due to enlargement. [8+8]

8. The following data refer to a radial, single stage, double suction, centrifugal pump:
   Discharge at the pump = 100 mm,
   Diameter at inlet = 100 mm
   Diameter at outlet = 290 mm
   Head = 36 m
   Speed of impeller =1750 r.p.m.
   Width at inlet = 25 mm per side,
   Width at outlet = 23 mm in total,
   Overall efficiency = 60%
   Leakage losses = 2.7 liters/ sec
   Mechanical losses = 1.5 kw
   Contraction factor due to vane thickness = 0.87 outlet vane angle = 27^0 .Assuming that water enters the impeller at inlet radialy, determine:

   (a) The inlet vane angle.
   (b) The angle at which water leaves the wheel.
   (c) The speed ratio.
   (d) The absolute velocity of the water leaving the impeller.
   (e) The manometric efficiency.
   (f) The Volumetric efficiency.
   (g) The Mechanical efficiency. [16]

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Code No: 07A52401 **R07** **Set No. 3**

III B.Tech I Semester Examinations,May 2011
FLUID MECHANICS AND HYDRAULIC MACHINERY
Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Briefly explain about the water hammer in pipes.
   (b) What is a surge tank. Draw and briefly explain about different types of surge tanks. [8+8]

2. Draw the velocity triangles of a pelton wheel and deduce expressions for power developed and efficiency? [16]

3. Explain the following in detail:
   (a) Surface tension.
   (b) Capillarity. [16]

4. A jet of water having a velocity of 18m/s strikes a curved vane which is moving with a velocity of 6m/s. The vane is symmetrical and so shaped that the jet is deflected through 120^0. Determine:
   (a) The angle of the jet at inlet of the vane so that there is no shock.
   (b) The absolute velocity of the jet at out let in magnitude and direction.
   (c) The work done per N of water. [16]

5. (a) Define slip, percentage slip and negative slip of a reciprocating pump.
   (b) Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump? [8+8]

6. (a) Compare of Hydro-power stations with thermal power stations.
   (b) Write a short note on hydro-power development in India. [8+8]

7. Two pipes 1and 2,each of 12cm diameter branch off from a point A in a pipe line and rejoin at B. Pipe 1 is 480m long and pipe 2 is 120m long. Total head at A is 36m. A short pipe 10cm diameter is fitted at B and the flow is discharged into atmosphere through it. Assuming f = 0.018 for both the pipes, calculate:
   (a) Total discharge,
   (b) Distribution of discharge in pipes 1 and 2. [16]

8. A pipe (1) 450mm in diameter branches into two pipes 2 & 3 of diameters 300mm and 200mm respectively. If the average velocity in 450mm diameter pipe is 3 m/sec, find.

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(a) Discharge through 450mm diameter pipe.

(b) Velocity in 200mm diameter pipe if the average velocity in 300mm pipe is 2.5 m/sec.

[16]

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