Code No: RR210201 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, November 2006
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The surface tension of water in contact with air at 20^0C is 0.073 N/m. The pressure inside a water droplet is $0.15kN/m^2$ greater than the outside pressure. Calculate the diameter of the water droplet. Derive the equation used.
   (b) Differentiate between absolute and gauge pressures. Calculate the pressure in N/m^2 due to a column of 0.4 m of
      i. water
      ii. oil of specific gravity 0.9 and
      iii. mercury.
      Assume specific weight of water as $9810N/m^3$. [8+8]

2. (a) Derive the continuity equation for one-dimensional flow.
   (b) Distinguish between stream line, path line and streak line. [8+8]

3. (a) Explain the different forms of energy in a fluid.
   (b) The cross-sectional area of a convergent pipe is so shaped that the velocity of flow along the centre line varies linearly from 1 m/s to 10 m/s in a distance of one metre. The pipe is inclined downward at an angle of 30^0 with horizontal. Determine the difference in pressure between the two points, assuming the specific weight of the liquid as $7.85kN/m^3$. [8+8]

4. (a) List the Minor losses of energy in a pipe flow.
   (b) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m and 600 m and diameters 750 mm, 600 mm and 450 mm respectively.
      i. Transform the system to an equivalent 450mm diameter pipe and
      ii. Determine an equivalent diameter for the pipe, 2550m long. [6+10]

5. A Venturitmeter having inlet diameter 100 mm and throat diameter 25 mm is fitted in a vertical pipe, throat 0.3 m below inlet, for measuring the flow of petrol of specific gravity 0.78. Pressure gauges are fitted at inlet and throat. Assuming the loss of head between inlet and throat as 30 times the velocity head at inlet, find
   (a) Cd for the meter
   (b) the discharge in liters per minute when the inlet gauge reads $274.68KN/m^2$ more than the throat gauge. [16]

6. A square plate weighing 115N and of uniform thickness and 30 cm edge is hung so that horizontal jet 2 cm diameter and having a velocity of 15 m/s impinges on the plate. The center line of the jet is 15 cm below the upper edge of the plate, and when the plate is vertical the jet strikes the plate normally and at its center. Find what force must be applied at the lower edge of the plate in order to keep plate vertical.If the plate is allowed to swing freely, find the inclination to vertical which the plate will assume under the action of jet. [16]

7. (a) Draw the typical velocity triangles at inlet and outlet for a pelton wheel and Francis turbine vanes.

   (b) Explain the Cavitation in Turbines. [8+8]

8. A Centrifugal pump is required to discharge 600 lts of water per second against a head of 12m, when running at a speed of 750 RPM. The manometric efficiency is to be 80 %, the loss of head in the pump being assumed to be 0.025 V_1 of water where V_2 is the absolute velocity of water leaving the impeller. Water enters the impeller without whirl and the velocity of flow is 3 m/s. Determine a

   (a) the impeller diameter and the outlet area and

   (b) the vane angle at the outlet edge of the impeller. [16]

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Code No: RR210201 **Set No. 2**

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HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
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1. (a) Differentiate between simple manometers and differential manometers.
   (b) Determine the gauge and absolute pressures in N/m^2 at a point on the free surface and at 4 m below the free surface of water. Take atmospheric pressure as 76 cm of Hg. [8+8]

2. (a) Derive the continuity equation for one-dimensional flow.
   (b) Distinguish between stream line, path line and streak line. [8+8]

3. A 300 mm diameter pipe carries water under a head of 20 metres with a velocity of 3.5 m/s. If the axis of the pipe turns through 45^0, find the magnitude and direction of the resultant force at the bend. [16]

4. (a) List the Minor losses of energy in a pipe flow.
   (b) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m and 600 m and diameters 750 mm, 600 mm and 450 mm respectively.
      i. Transform the system to an equivalent 450mm diameter pipe and
      ii. Determine an equivalent diameter for the pipe, 2550m long. [6+10]

5. (a) A pipe carries a flow of an oil of relative density 0.85. A pitot-static tube is inserted into the pipe to measure the velocity at a point M. If differential mercury ?oil gauge connected to the pitot-static tube indicates a reading of 4cm, calculate the velocity at M. Assume the coefficient of the pitot tube as 0.99.
   (b) Describe with the help of sketch, the construction, operation and use of pitot-static tube. [8+8]

6. A jet of water, cross-sectional area $20cm^2$,issues with a velocity of 25m/s and strikes a stationary plate held at 30^0 to the axis of jet.Find the force exerted by the jet on the plate,and work out the components of force in the direction normal to the jet.Also find how the discharge gets distributed after striking the plate. [16]

7. (a) Explain different efficiencies of a hydraulic turbine
   (b) A Pelton wheel is having a mean bucket diameter of 0.8 m and is running at 1000 rpm. The net head on the pelton wheel is 400 m. If the side clearance angle is 15^0 and discharge through the nozzle is 0.15 m^3/s, find the hydraulic efficiency of the turbine. [8+8]

8. The impeller of a centrifugal pump has 1.2 m outside diameter. It is used to lift 1800 litres of water per second against a head of 6 m. Its vanes make an angle of 150^0 with the direction of motion at outlet and runs at 200 rpm. If the radial velocity of flow at outlet is 2.5 m/s, find the manometric efficiency. Also find the lowest speed to start the pump, if the diameter of the impeller at inlet is equal to half the diameter at exit. [16]

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Code No: RR210201 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, November 2006
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State the Newton?s law of viscosity and explain the importance of viscosity in fluid motion.
   (b) A 25 mm wide vertical gap of infinite length contains oil of viscosity 3.6 Pa s. A metal plate 1.2 m x 1.3 m x 0.018 m weighing 45 N is to be lifted through this gap at a constant speed of 0.15 m/s. Estimate the force necessary to lift the plate. [8+8]

2. (a) Derive the continuity equation for one-dimensional flow.
   (b) Distinguish between stream line, path line and streak line. [8+8]

3. (a) Explain the different forms of energy in a fluid.
   (b) The cross-sectional area of a convergent pipe is so shaped that the velocity of flow along the centre line varies linearly from 1 m/s to 10 m/s in a distance of one metre. The pipe is inclined downward at an angle of 30^0 with horizontal. Determine the difference in pressure between the two points, assuming the specific weight of the liquid as $7.85kN/m^3$. [8+8]

4. (a) Derive the Darcy -Weisbach equation for the loss of head due to friction in a pipe.
   (b) Find the loss of head due to friction in pipe carrying water. The pipe is 300 m long and 15 cm in diameter. The discharge through the pipe is $0.04m^3/s$. Take friction factor as 0.04. [8+8]

5. Water flows at the rate of 150 litres per second through a 0.015m diameter orifice in a 0.03m diameter pipe. If the pressure gauges fitted upstream and down stream of the orifice indicate readings of 2 bar and 1 bar respectively, calculate the discharge coefficient of the orifice meter. [16]

6. (a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
   (b) A jet of water of diameter 50 mm strikes a fixed plate in such a way that the angle between the plate and jet is 30^0. The force exerted in the direction of the jet is 1471.5 N. Determine the rate of flow of water. [8+8]

7. (a) How is a Kaplan turbine different from a Propeller turbine
   (b) What are the functions of draft tube in a Reaction turbine. [8+8]

8. A Centrifugal pump is required to discharge 600 lts of water per second against a head of 12m, when running at a speed of 750 RPM. The manometric efficiency is to be 80 %, the loss of head in the pump being assumed to be 0.025 V_1 of water where V_2 is the absolute velocity of water leaving the impeller. Water enters the impeller without whirl and the velocity of flow is 3 m/s. Determine a

   (a) the impeller diameter and the outlet area and

   (b) the vane angle at the outlet edge of the impeller. [16]

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Code No: RR210201 **Set No. 4**

II B.Tech I Semester Supplementary Examinations, November 2006
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain how vacuum pressure is measured with the help of a U-tube manometer.
   (b) The barometric pressure at sea level is 760 mm of Hg while on a mountain top it is found to be 735 mm of Hg. If the specific weight of air is assumed constant at $11.8N/m^3$, calculate the height of the mountain. [8+8]

2. (a) Derive the continuity equation for one-dimensional flow.
   (b) Distinguish between stream line, path line and streak line. [8+8]

3. (a) State the assumptions made in the derivation of Bernoulli's equation. State the momentum equation and explain its significance.
   (b) The water is flowing through a taper pipe of length 100cm having diameters 800mm at the upper end and 400mm at the lower end, @ the rate of $60 \times 10^{-3}m^3/s$. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure @ the higher level is $20N/m^2$. [8+8]

4. (a) Derive an expression for turbulent shear stress.
   (b) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300mm at the rate of $0.5m^3/s$. Find the head loss due to friction and power required to maintain the flow for a length of 1000m. Assume kinematic viscosity of oil as 0.3 stokes. [8+8]

5. Sketch the venturimeter and manometer arrangement, and derive an expression for the actual flow rate of an incompressible fluid? [16]

6. A square plate weighing 115N and of uniform thickness and 30 cm edge is hung so that horizontal jet 2 cm diameter and having a velocity of 15 m/s impinges on the plate. The center line of the jet is 15 cm below the upper edge of the plate, and when the plate is vertical the jet strikes the plate normally and at its center. Find what force must be applied at the lower edge of the plate in order to keep plate vertical.If the plate is allowed to swing freely, find the inclination to vertical which the plate will assume under the action of jet. [16]

7. An axial flow turbine operates under a head of 21.8m and develops 21MW when running at 140 RPM. The external runner diameter is 4.5m and the hub diameter is 2m. If the hydraulic efficiency is 94% and the overall efficiency is 88%, determine the inlet and outlet blade angles. [16]

8. (a) What are the different heads and efficiencies used in Centrifugal pumps. Explain.
   (b) Obtain the equation for minimum starting speed of a Centrifugal pump. [8+8]

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