II B.Tech. I Semester Regular Examinations, November -2005
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Why do liquids and gases show contrast with regard to variation of viscosity with temperature?
   (b) Explain the working of a simple U-tube manometer. What are the advantages of this manometer over a piezometer? [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. Two reservoirs with a difference in water surface elevation of 10 m are connected by a pipeline ABC, which consists of two pipes AB and BC joined in series. Pipe AB is 10 cm in diameter, 20 m long and has a value of f = 0.02. Pipe BC is of 16 cm diameter, 25 m long and has a f = 0.018. The junctions with the reservoirs and between the pipes are abrupt.
   (a) calculate the discharge,
   (b) what difference in water elevations is necessary to have a discharge of 15 litres/sec. (include all minor losses). [16]

5. (a) Carbon tetrachloride (specific gravity = 1.60) flows through a pipe. Calculate the velocity if the differential manometer attached to the pitot-static tube shows a deflection of 8 cm of mercury (specific gravity = 13.6) take the coefficient of the tube as unity.
   (b) A pitot-static tube is used to measure the speed of an air-plane. If the pressure difference shown by a U-tube manometer is equivalent to 0.lm of water, find the speed of the air-plane. The specific weight of air is $11.870N/m^3$. Take the coefficient of the pitot tube as 0.99 and neglect the compressibility effects in air. [8+8]

6. Water enters a wheel consisting of curved vanes, outside diameter 1m, inside diameter 0.5m. the flow is inwards from the circumference. The supply jet is at 30^0 to the tangent to the outside circle with a velocity of 40m/s. The water is to leave

the wheel at 3.5m/s at 120^0 to the tangent to the inner circle. Draw the velocity triangles for the inlet and outlet and find suitable blade angles if the wheel runs at 360 r.p.m. [16]

7. Draw the general layout of a Hydro-Electric Power plant and explain the working.

[16]

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]

⋆ ⋆ ⋆ ⋆ ⋆

II B.Tech. I Semester Regular Examinations, November -2005
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

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) 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 pipe having a length of 6km and diameter 0.70 m connects two reservoirs A and B, the difference between their water levels is 30 m. Halfway along the pipe there is a branch through which water can be supplied to a third reservoir C. Taking f = 0.024 determine the rate of flow of reservoir B when
   (a) no water is discharged to reservoir C;
   (b) the quantity of water discharged to reservoir C is $0.15m^3/s$ .Neglect minor losses. [16]

5. A 10cm× 5cm venturimeter with a coefficient of discharge of 0.95 is to be replaced by an orifice meter having a coefficient of discharge of 0.6.If both the manometers are to give the same differential mercury manometer reading for a discharge of 200 litres per second, and the inlet diameter is to remain 10cm,what should be the diameter of orifice? [16]

6. A jet of water 75mm diameter having a velocity of 20m/s, strikes normally a flat smooth plate. Determine the thrust on the plate.
   (a) if the plate is at rest,
   (b) if the plate is moving in the same direction as the jet with a velocity of 5m/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. [16]

7. An inward flow reaction turbine is supplied with water at the rate of 600 lps with a velocity of 2 m/s. The velocity of periphery and velocity of whirl at inlet is 24 m/s and 18 m/s respectively. Assuming the discharge to be radial at outlet and the velocity of flow to be constant, find:

   (a) vane angle at inlet and

   (b) head of water exerted on the wheel. [16]

8. A double acting reciprocating pump has a stroke of 25 cm and piston diameter of 12.5 cm. The center of the pump is 4m above the level of water in the sump and 30 m below the delivery water level. The lengths of suction and delivery pipes are 6 m and 35 m respectively and their diameters are both 6 cm. If the pump is running at 30 rpm, estimate the pressure head developed on the piston in m of water at

   (a) the beginning of the suction stroke,

   (b) the middle of suction stroke, and

   (c) the end of suction stroke.
   If the mechanical efficiency is 80%, determine the power required to drive the pump. Take atmospheric pressure as 10.3 m of water and 4f = 0.04. [16]

⋆ ⋆ ⋆ ⋆ ⋆

II B.Tech. I Semester Regular Examinations, November -2005
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Describe with the help of neat sketches different types of manometers.
   (b) Why is Pascal's law inapplicable in real flow situations? [8+8]

2. (a) Briefly explain the classification of flows.
   (b) What type of acceleration is to be expected if
      i. Streamlines are parallel and equidistant
      ii. Streamlines are straight and converging
      iii. Streamlines are curved but equispaced
      iv. Streamlines are curved and converging. [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. Water flows in a 250mm pipe. Two pitot tubes are installed in the pipe, one on the centerline and the other 50mm from the centerline. If the velocities at the two points are 3m/s and 2m/s respectively calculate the reading on the differential mercury manometer connected to the two tubes. [16]

6. A jet of 4 cm in diameter having a velocity of 30 m/s strikes tangentially at one edge on a wheel, which deflects the jet through an angle of 120^0. Calculate the thrust on the vane when
   (a) the axis of symmetry of the vane is horizontal
   (b) the tangent at inlet tip is horizontal. [16]

7. An inward flow reaction turbine has outer and inner diameters of the wheel as 1 m and 0.5 m respectively. The vanes are radial at inlet and the discharge is radial. Water enters the vanes at an angle of 10^0. Assuming the velocity of flow as 3 m/s and constant, find the speed of the wheel and the vane angle at outlet. [16]

8. What is an indicator diagram of a reciprocating pump? Sketch the theoretical indicator diagram for a single acting-reciprocating pump not fitted with an air vessel. With the help of the diagram explain clearly the effect of acceleration and friction on both suction and delivery strokes. [16]

⋆ ⋆ ⋆ ⋆ ⋆

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

II B.Tech. I Semester Regular Examinations, November -2005
HYDRAULICS AND HYDRAULIC MACHINERY
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

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) Briefly explain the classification of flows.
   (b) What type of acceleration is to be expected if
      i. Streamlines are parallel and equidistant
      ii. Streamlines are straight and converging
      iii. Streamlines are curved but equispaced
      iv. Streamlines are curved and converging. [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. The density of air in a duct is to be $1.2kg/m^3$ and its maximum velocity is 20 m/s. The duct is 100mm diameter and the velocity is to be measured using 70mm diameter orifice. If coefficient of discharge is 0.6,calculate the necessary range of manometer in mm of water. [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) Write the difference between the inward flow and outward flow turbines.
   (b) Show that in a turbine with radial vanes at inlet and outlet, the hydraulic efficiency is given by $\eta h = 2/ (2 + \tan^2 \alpha)$ where α is the guide blade angle. Assume the velocity of flow to be constant. [8+8]

8. (a) Derive the equation for the power required to drive the double acting reciprocating pump.
   (b) A single acting reciprocating pump runs at 60 RPM. The diameter of the plunger is 0.15m and crank radius is 0.15m. The suction pipe is 0.1m in diameter and 5m long. Calculate the maximum permissible value of suction lift, if the separation takes place at 2.6m of water absolute. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆