SET - 1

Code No: 3220304

II B. Tech II Semester Regular Examinations April/May 2009
FLUID MECHANICS AND HYDRAULIC MACHINERY
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 80**

Answer any FIVE questions.
All questions carry equal marks
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1. (a) The specific gravity of a liquid is 3.0, what are its specific weight, specific mass and specific volume?
   (b) A body weighing 45 kg with a flat surface area of 930 cm^2 slides down lubricated inclined plane making a 30° angle with the horizontal. For viscosity of 1 poise and body speed of 3 m/sec, determine the lubricant film thickness.

2. (a) Define and distinguish between streamline, path line and streak line
   (b) State and derive Bernoulli's theorem, mentioning clearly the assumption underlying it.
3. Derive an expression for mean velocity for laminar flow (i) through pipe; (ii) between parallel plates.
4. (a) Define the terms: (a) Impact of jets, and (b) Jet propulsion.
   (b) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
5. What are the uses of draft tube? Describe with neat sketches different types of draft tubes.
6. (a) What is the basis of selection of a turbine at a particular place?
   (b) What are unit quantities? Define the unit quantities for turbine.
7. A pelton wheel has a mean bucket speed of 35 m/s with a jet of water flowing at the rate of 1 m^3/s under a head of 270 m. the buckets deflect the jet through an angle of 170°. Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity at 0.98.
8. Define a centrifugal pump. Explain the working of a single stage centrifugal pump with neat sketches.

SET - 2

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Answer any FIVE questions.
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1. (a) If 5.27 cm^3 of a certain oil weighs 4482 kg, calculate the specific weight, mass density and specific gravity of the oil.
   (b) Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in (i) water, and (ii) mercury. The temperature of the liquid is 20° C and the values of the surface tension of water and mercury at 20° C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero that for mercury 1.30°. Take density of water at 20°C as equal to 998 kg/m^3.
2. (a) Define and distinguish between (a) steady and unsteady flow, (b) uniform and non-uniform flow, (c) rotational and irrotational flow.
   (b) A 30 cm X 15 cm venturimeter is inserted in vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. find the discharge. Take $C_d = 0.98$
3. (a) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 liters/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000 m. Take $\nu = 0.29$ stokes.
   (b) What do you understand by the terms: major energy loss and minor energy losses in pipes?
4. A bend in pipeline conveying water gradually reduces from 60 cm to 30 cm diameter and deflects the flow through angle of 60°. At the larger end the gauge pressure is 1.75 kg/cm^2. Determine the magnitude and direction of the force exerted on the bend, (a) when there is no flow, (b) when the flow is 876 liters per sec.
5. (a) How will you classify the turbines?
   (b) Differentiate between turbines and pumps.
6. What do you understand by the characteristics curves of turbine? Name the important characteristics of a turbine.

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7. Differentiate: (i) between a single acting and double acting reciprocating pump, (ii) between a single cylinder and double cylinder reciprocating pump.
8. Draw and discuss the operating characteristics of a centrifugal pump

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1. (a) What is the difference between dynamic viscosity and kinematic viscosity? State their units of measurements.
   (b) A U- tube mercury manometer is used to measure the pressure of oil flowing through a pipe whose specific gravity is 0.85. The center of the pipe is 15 cm below the level of mercury. The mercury level difference in the manometer is 25 cm, determine the absolute pressure of the oil flowing through the pipe. Atmospheric pressure is 750 mm of Hg.
2. (a) What is meant by one-dimensional, two-dimensional and three-dimensional flows?
   (b) The water is flowing through a taper of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 liters/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2.
3. (a) What do you mean by viscous flow.
   (b) Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of 2.0 m/s. Find the total head or total energy per unit weight of the water at a cross section, which is 5 m above the datum line.
4. A jet of water of diameter 50 mm moving with a velocity of 20 m/s strikes a fixed plate in such a way that the angle between the jet and the plate is 60°. Find the force exerted by the jet on the plate (i) in the direction normal to the plate, and (ii) in the direction of the jet.
5. (a) Explain briefly the principles on which a Kaplan turbine works.
   (b) Explain the different types of the efficiency of a turbine
6. (a) What is cavitation? How can it be avoided in reaction turbine.
   (b) Draw a neat sketch of Pelton turbine and Francis turbine.

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7. (a) How will you classify the reciprocating pumps?
   (b) Define slip, percentage slip and negative slip of reciprocating pump.
8. What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of centrifugal pump.

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(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 80**

Answer any FIVE questions.
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1. (a) What is the difference between U-tube differential manometers and inverted U-tube differential manometers? Where are they used.
   (b) A plate, 0.025 mm distant from a fixed plate, moves at 50 cm/s and requires a force of 1.471 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates in the poise.
2. (a) Differentiate between forced vortex and free vortex flow.
   (b) Water flow through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and diameter of CE.
3. (a) Write the assumptions made in the derivation of Bernoulli's equation
   (b) Calculate: (a) the pressure gradient along flow, (b) the average velocity, and (c) the discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1 m wide maintained 10 mm apart. The velocity midway between the plates is 2m/s.
4. A jet of water of diameter 100 mm moving with a velocity of 30 m/s strikes a curved fixed symmetrical plate at the center. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120° at the outlet of the curved plate.
5. What is a surge tank and a forebay and what are their functions? Describe with neat sketches different types of surge tanks.
6. (a) Differentiate between an inward and an outward flow reaction turbine.
   (b) What is specific speed? State its significance in the study of hydraulic machines.

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7. What is a reciprocating pump? Describe the principle and working of reciprocating pump with a neat sketch. Why is reciprocating pump not coupled directly to the motor? Discuss the reason in detail.
8. Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump.