Code No: 09A52401 R09

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, November/December - 2012**
**MECHANICS OF FLUIDS AND HYDRAULIC MACHINERY**
**(Automobile Engineering)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any Five Questions**
**All Questions carry equal marks**
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1.a) Define Viscosity, Surface tension and Vapor Pressure and explain their influence on fluid motion.

b) A inverted U-tube manometer is connected to two horizontal pipes. A and B through which water is flowing. The vertical distance between the axes of these pipes 30 cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes. [15]

2.a) The velocity components in a two-dimensional flow are : $u = y^3/3 + 2x - x^2y$ and $v = xy^2 - 2y - x^3/3$. Show that these components represent a possible case of an irrotational flow.

b) A pipe of 20 cm diameter conveying 0.20 $m^3$/sec of water has a right angled bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 22.563 $N/cm^2$ and 21.582 $N/cm^2$ respectively. [15]

3.a) Derive an expression for calculating loss of head in a pipe flow due to i) Sudden enlargement, and (ii) Sudden contraction.

b) Three pipes of lengths 800 m, 600 m and 300 m and of diameter 400mm, 300 mm and 200 mm respectively are connected in series. The ends of the compound pipe is connected to two tanks, whose water surface levels are maintained at a difference of 15 m. Determine the rate of flow of water through the pipes if f = 0.005. What will be the diameter of a single pipe of length 1700 m? And f = 0.005, which replaces the three pipes. [15]

4. Derive an expression for efficiency of moving curved vane where jet enters one of its tip and leaves at other tip of the vane. [15]

5.a) Classify the hydal schemes according to available head . Draw a sketch to show a general layout and section of a high head scheme.

b) What is a surge tank? Discuss its function and working with a neat sketch. [15]

6.a) Differentiate between Radial and axial flow turbines.

b) The following data pertain to an inward flow reaction turbine:
Diameter of wheel at inner periphery = 540 mm; Width of wheel at inner periphery = 60 mm ; Diameter of wheel at outer periphery = 360 mm; Width of wheel at outer periphery = 90 mm; Area occupied by the vanes = 8% of the periphery; Guide vane angle = $25^0$ to the tangent to the runner; Moving vane angle at inlet = $95^0$ (vane inclined forward to the direction of motion); Exit angle = $30^0$; Hydraulic losses = 10% of the supply head; Mechanical friction losses = 5% of the supply head; Pressure in the outer casing = 66 m more than that at discharge from the runner. Determine the following: (i) Speed of the runner (for no shocks at entry), and (ii) Power available at the turbine shaft. [15]

7.a) Define the terms: specific speed of a turbine, unit speed, unit power and unit rate of flow of a turbine. Derive the expressions for specific speed and unit speed.

b) A 1/6 reduced scale model of a Francis turbine develops 7.5 KW of power under a head of 10 m. Its speed is 475 rpm. It consumes 90 lps of water. What is the overall efficiency of the model? Assuming the same efficiency for the prototype machine, determine its rpm, specific speed, power output and discharge if it has to work under a head of 125 m. [15]

8.a) Explain the term negative slip of a reciprocating pump.

b) The internal and external diameters of the impeller of a centrifugal pump are 20 cm and 40 cm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are $20^0$ and $30^0$ respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per kg. of water. [15]

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