

Code No: 07A3EC02

**R07****Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

**FLUID MECHANICS AND HYDRAULIC MACHINERY**

Common to Production Engineering, Electrical And Electronics Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) A 20 cm diameter jet of oil of specific gravity 0.85 strikes a stationary flat plate at an angle of 35 degrees to the normal. Estimate the force exerted on the plate when the velocity of the jet is 25m/sec.
- (b) Prove that the force exerted by a jet of water on a moving hemispherical curved vane when the jet strikes at the centre is  $F = 2 \rho a (V-u)^2$  where  
 $\rho$  = Mass density of water  
 $a$  = Area of cross section of the jet  
 $V$  = Velocity of the jet.  
 $u$  = Velocity of the vane in the direction of the jet. [8+8]
2. (a) How will you obtain an expression for the minimum speed for starting a centrifugal pump?
- (b) Find the rise in pressure in the impeller of a centrifugal pump through which water is flowing at the rate of 15 lit/s. The internal and external diameters of the impeller are 20 cm and 40 cm respectively. The widths of impeller at inlet and outlet are 1.6 cm and 0.8 cm. The pump is running at 1200 r.p.m. The water enters the impeller radially at inlet and impeller vane angle at outlet is  $30^\circ$ . Neglect losses through the impeller. [16]
3. (a) Explain how do you measure the velocity of flowing water in a stream using pitot tube.
- (b) An oil of relative density 0.90 flows through a vertical pipe of diameter 20cm. The flow is measured by a 20cm  $\times$  10cm venturimeter. The throat is 30cm above the inlet section. A differential U tube manometer containing mercury is connected to the throat and the inlet. If coefficient of discharge is 0.99 what is the manometer reading for a flow of 50lit/sec. [6+10]
4. (a) Draw a schematic diagram of a Francis turbine and explain briefly its construction and working.
- (b) A Pelton wheel having a mean bucket diameter of 1.0 m is running at 1000 r.p.m. the side clearance angle is  $15^\circ$  and discharge through the nozzle is 0.1 m<sup>3</sup>/s, determine power available at the nozzle and hydraulic efficiency of the turbine. [16]
5. (a) Define the terms 'unit power', 'unit speed' and 'unit discharge' with reference to a hydraulic turbine. Also derive expressions for these terms.
- (b) Sketch and describe a modern method of regulation to maintain a constant speed for either

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- i. Pelton wheel or  
ii. Francis turbine. [8+8]
6. (a) Describe different types of pumped storage plants what are the relative merits of them.  
(b) Explain what is mass curve and how it is constructed. Draw a neat sketch. [8+8]
7. (a) Define the Bernoulli's equation and discuss its application in fluid mechanics.  
(b) A conical pipe has diameters 0.40 m and 0.80 m at its two ends. The smaller end is 2m above the larger end. For a flow of  $0.30 \text{ m}^3/\text{sec}$ , of water the pressure at lower end is 10 Kpa. Assuming a head loss of 2m estimate the pressure at the smaller end. [8+8]
8. (a) What are the pressure measuring devices? Explain the working of an inverted U tube differential manometer.  
(b) A pipe containing water at  $172 \text{ KN/m}^2$  pressure is connected by a differential gauge to another pipe 1.5m lower than first pipe and containing water at high pressure. If the difference in the heights of the two mercury columns of the gauge is equal to 75mm, what is the pressure in the lower pipe? Specific gravity of mercury is 13.6. [8+8]

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6. (a) Explain how do you measure the velocity of flowing water in a stream using pitot tube.

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- (b) An oil of relative density 0.90 flows through a vertical pipe of diameter 20cm. The flow is measured by a 20cm × 10cm venturimeter. The throat is 30cm above the inlet section. A differential U tube manometer containing mercury is connected to the throat and the inlet. If coefficient of discharge is 0.99 what is the manometer reading for a flow of 50lit/sec. [6+10]
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