PVP 12

Code: ME3T3, AE3T4

II B.Tech - I Semester – Regular Examinations - December 2014

FLUID MECHANICS AND HYDRAULIC MACHINES

(Common for ME, AE)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Define precisely what is a fluid and Derive an expression for Pascal's Law. 7 M

   b) A tank of 0.9m square in plan, contains water to a depth of 0.6m on top of which was oil of specific gravity 0.85 to a depth of 0.3m. Determine the total pressure exerted on one of the vertical faces of the tank and the position at which it may be taken as acting. 7 M

2. a) Define continuity equation and derive continuity equation for three dimensional Cartesian coordinates. 7 M

   b) Oil of specific gravity 0.9 and viscosity 1 poise is pumped through a 5cm diameter pipe at the rate of 280 litre/min. Show that the flow is streamline and hence estimate the power required to pump oil up through a pipe line 75m long which rises 7.5m over this length. 7 M

3. a) An old water supply distribution pipe of 250 mm diameter of a city is to be replaced by two parallel pipes of smaller equal diameter having equal lengths and identical friction factors values, find out the new diameter. 7 M

b) If the pipe of two different diameters are used to connect two reservoir A and B, first 150m of 20cm diameter and followed by 100cm of 15cm diameter. Calculate the flow rate from the reservoir A to B, when H_a is 6m and H_b is 2m, Z_a is 100m and Z_b is 4m. Darcy Weisbach friction factor for both the sections of the pipe is 0.015. 7 M

4. a) Derive an expression for discharge through a venturimeter. 7 M

b) The flow of air through a 50mm diameter pipe is to be measured by inserting a 30mm diameter orifice in a pipe line. The pressure difference across the orifice is measured by a differential U tube manometer is 15cm of water. The pressure and temperature are 1.035 bar and 17°C respectively. Determine the mass of air in kg/h flowing through the pipe line if coefficient of discharge is 0.0605. 7 M

5. a) Derive an expression for a Hydro dynamic force of a jet striking a stationary curved plate. 7 M

b) A jet of water of diameter 50 mm moving with a velocity of 25 m/s impinges on a fixed curved plate tangential at one end at an angle of 30° to the horizontal. Calculate the resultant force of the jet on the plate if the jet is deflected through an angle of 50°. 7 M

6. a) A Francis turbine working under a head of 5 m at a speed of 210 rpm develops 75 kW when the rate of flow of water is 1.8 m^3/ sec. If the head is increased to 16 m, determine the speed, discharge and power. 7 M

b) It is desired to generate 1000 kW of power and survey reveals that 450 m of static head and a minimum flow of 0.3 m^3/s is available. Comment whether the task can be accomplished by installing a Pelton wheel that turns 1000 revolutions per minute and has an efficiency of 80%. Further design the Pelton wheel by assuming suitable data for constant velocity, speed ratio and velocity coefficient for the jet. 7 M

7. a) Derive an expression for minimum starting speed for a centrifugal pump. 7 M

b) A centrifugal pump delivers water against a net head of 14.5 metres and a design speed of 1000 rpm. The vanes are curves back at an angle of 30° with the periphery. The impeller diameter is 300 mm and the outlet width is 50 mm. Determine the discharge of the pump if manometric efficiency is 95%. 7 M

8. a) What are air vessels and why are they used in a reciprocating pumps, justify. 7 M

b) A single acting reciprocating pump has its piston diameter 15 cm and stroke 30 cm. If it discharges 300 litres of water per minute at 60 rpm. The suction and delivery heads are 5 m and 15 m respectively. Find the theoretical discharge, coefficient of discharge. 7 M