B.E./B.Tech END SEMESTER EXAMINATIONS, NOV/DEC 2011

MECHANICAL ENGINEERING

3rd SEMESTER – FULL TIME (R-2008)

CE 9211 – Fluid Mechanics and machinery
(Common to Manufacturing, Industrial & Mining Engineering)

Time : 3 Hrs Max.mark: 100

Answer all Questions

PART – A (10 x 2 = 20)

1. Define Ideal fluid
2. If the surface tension at air water interface is 0.060 N/m, Calculate the pressure difference between inside and outside of an air bubble of diameter 0.006 mm
3. Differentiate Euler and Lagrange's approach with respect to a fluid
4. Sketch the development of boundary layer on a thin flat plate with relevant labelling.
5. State Buckingham π theorem
6. A tank filled with water is drained through a bottom hole 2 cm in dia in 32 seconds. Find the time required for kerosene to drain from a geometrically similar tank (2.5 times its size) having a 5 cm dia hole at the bottom. Neglect viscous effects.
7. Define governing of turbines. How it is achieved?
8. Differentiate centrifugal and reciprocating pumps?
9. Define Equivalent pipe.
10. What is known as negative slip of reciprocating pumps? When it will occur?

PART – B

11. (i) A lubricating oil in a 5 litre container weighs 55 N. Calculate its specific weight, density, specific volume and relative density. (8 marks)

    (ii) A painter is painting a wall 3m x 4m with a brush 10 cm wide and 1.25 cm thick. The thickness of one coat of paint is 0.5 mm and the viscosity of paint is 3 N-s/m^2. Calculate the total work required for painting one side of the wall if he moves the brush with a velocity of 10 cm/s. (8 marks)

12. (a) (i) Derive Darcy Weisbach equation for friction loss (10 marks)

    (ii) Enlist other minor losses with relevant formulae. (6 marks)

(OR)

12.(b) Two reservoirs of water are connected by a pipeline ABCD of 20 cm dia as shown in fig 12(b). The lengths are : AB = 150 m, BC = 200 m, CD = 120 m. A loss of head of 2.75 m occurs in the partially opened valve at C. The steady discharge through the pipeline is 60 litres/sec. AB is an old pipe of friction factor f_1 and BCD is a new pipe of friction factor f_2. If the pressure at B is 5.8 cm of mercury (Vacuum), calculate f_1 and f_2. Neglect losses at bends but consider other losses. What power is required to pump the water up from the low to high level reservoir through the same system at the same discharge? (16 marks)

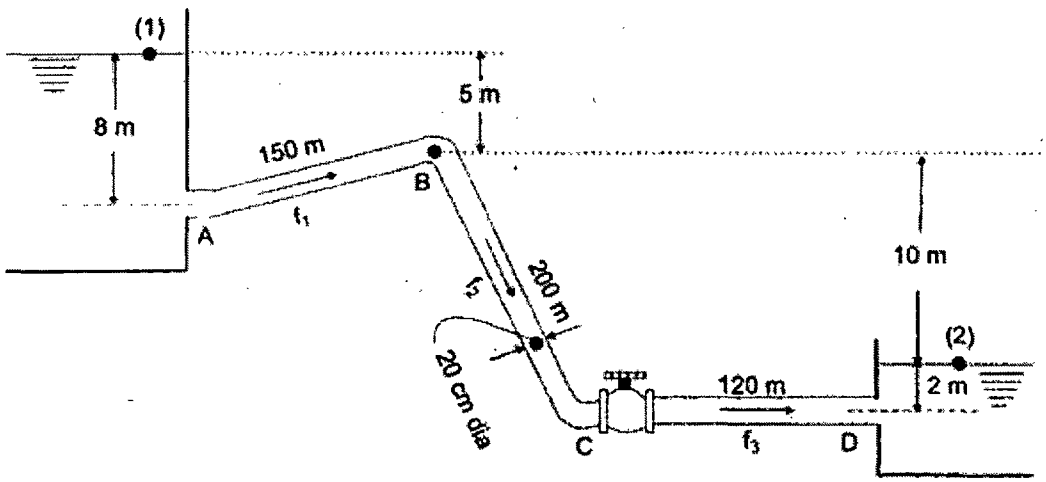

Fig 12.(b)

13. (a) The discharge Q over a sharp crested weir of height W spanning across a rectangular channel of width B depends on the head H over the weir, gravitational acceleration g and the fluid properties ρ, μ and σ. Perform dimensional analysis for Q. (16 marks)

(OR)

13.(b) A Ship 300 m long moves in sea water, whose density is 1030 kg/m^3. A 1 : 100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60 N. Determine the velocity of ship in sea water and also the resistance of the ship in sea water. The density of the air is given as 1.24 kg/m^3. Take the kinematic viscosity of the sea water and air as 0.012 stokes and 0.018 stokes respectively. (16 marks)

14.(a) A Francis turbine is required to give an output power of 15,000 kW while working under a head of 14 cm and a speed of 300 rpm. Calculate the guide vane and runner angles and the leading dimensions of the runner. Assume overall efficiency = 80%, hydraulic efficiency = 88%, speed ratio = 0.75, flow ratio = 0.15, ratio of outer to inner diameter = 0.6 and percent flow area blocked by runner vanes thickness = 4. (16 marks)

(OR)

14.(b) Determine the appropriate scale ratio for a Kaplan turbine model to work under a head of 5 m and use water at the rate of 1.96 m^3/s. The proto type machine works under a head of 15 m and produces a power of 30,000 metric H.P with a specific speed of 850. Assume that the model and prototype have same overall efficiency of 90%. Calculate the speed and power output of the model. (16 marks)

15.(a) (i) Explain the purpose and principle of working of air vessels of reciprocating pumps. Enlist their advantages (6+3 marks)

(ii) Find out the work saved by the usage air vessels in single acting and double acting reciprocating pumps. (7 marks)

(OR)

15.(b) Write a short note on following types of rotary pumps: (4+4+4+4 marks)

(i) Internal gear pump (ii) External gear pump

(iii) Vanes pumps (iv) Roots pump
