Reg.No								

(12)

BE (FULL TIME) DEGREE END SEMESTER EXAMINATIONS , APRIL/MAY 2011

COMMON TO MANUFACTURING AND INDUSTRIAL ENGINEERING
Fourth Semester
CE 291 FLUID MECHANICS AND MACHINERY
(Regulation 2004)

Time : 3 hours **Max. Marks : 100**

Instructions : Answer All Questions

PART A **10 X 2 = 20 marks**

1. What is fluid and solid?
2. List the thermodynamic properties in the context of fluid mechanics.
3. Define stream line and path line in a fluid flow?
4. Write the Euler's equation of motion and Bernoulli's Equation.
5. Draw sketch of Total Energy Line and Hydraulic Gradient Line in a pressure flow.
6. What is scale effect in hydraulic modeling?
7. Deduce the dimensionless number of inertia force to viscous force?
8. Differentiate between two types of turbine based on the energy.
9. What is positive displacement pump?
10. What are the functions of Air vessel in reciprocating pump?

PART B **5 X 16 = 80 marks**

11.(i) Show that the velocity through a circular orifice is given by $V= (2gH)^{0.5}$ f(D/H , μ /(ρVH)). Where **H** is head causing flow, **D** is diameter of orifice, μ is coefficient of viscosity, **ρ** is mass density and **g** is acceleration due to gravity. Use Buckingham π theorem. (8)

(ii) A ship 250m long moves in sea-water, whose density is 1030kg/m^3. A 1:100 model of this ship is to be tested in wind tunnel. The velocity of air in the wind tunnel around the model is 20m/s and the resistance of the model is 40.5 N. Determine the velocity of ship in sea-water and also the resistance of the ship in sea-water. The density of air is given as 1.24 kg/m^3. Take kinematic viscosity of sea-water and air as 0.012 stokes and 0.018 stokes respectively. (8)

12.a) A child is sledding down an ice covered hill. Each of the two runners on the sled has dimensions of 1.1 m by 1.3 cm. The sled is supported on a thin film of water [h = 0.15 mm, μ= 0.001 kg/(m-s)] created by a local melting of the ice due to the pressure exerted by the sled. If the child is cursing at a velocity of 8 m/s, calculate: i) the total shear stress on the runners of the sled ii) the shear strain rate for this flow iii) the magnitude of the force on one of the runners of the sled. (16)

(OR)

12.b)(i) Derive an expression for the continuity equation of a three dimensional fluid flow in Cartesian co-ordinate system? (9)

(ii) Explain with sketch the principle of Venturimeter for the measurement of discharge? (7)

13a) Derive an expression for steady laminar flow through circular pipes and prove that the U_{max}/V_{avg} =2, and head loss between two sections is 32 ν V L/(g D^2), where ν is kinematics viscosity. Draw the necessary sketch. Also state the velocity and shear stress distribution. (16)

(OR)

13b i) A pipe line AB of diameter 300 mm and of length 400 m carries water at a rate of 50 litres per second. The flow takes place from A to B where the point B is 30 m above A. Find the pressure at A, if the pressure at B is 19.62 N/cm^2. Assume coefficient of friction is 0.008. (8)

(ii) An oil of viscosity 0.1 Ns/m^2 and relative density 0.85 is flowing through a circular pipe of diameter 50 mm and of length 500 m. rate of flow of fluid to the pipe is 3.5 litres per second. Find the pressure drop for a length of 500 m. (8)

14.a)(i) What is runaway speed and specific speed of turbine? (4)

(ii) The Francis turbine with an overall efficiency of 75 % is required to produce 150 kW power. It is working under a head of 7.62 m The propeller velocity is 0.26 times theoretical velocity and the radial velocity of flow at inlet is 0.96 times theoretical velocity. The wheel runs at 150 rpm and the hydraulic losses in the turbine is 22 % of the energy available. Assume radial flow at outlet of the turbine. Determine the guide blade angle, wheel vane angle at inlet, diameter and width of the wheel at inlet. (12)

(OR)

14 b) The centrifugal pump has the following characteristics. Outer diameter of impeller is 800 mm; width of the impeller vane at outlet is 100 mm. Angle of the impeller vanes at outlet is 40 degree. The impeller runs at 550 rpm and delivers 0.98 m^3/s under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially at inlet. (16)

15.a) Determine the total head, discharge and overall efficiency of a single acting three through pump from the following details:
Diameter of each cylinder is 280 mm, stroke length is 420 mm, crank speed 120 rpm. Suction head 3 m, suction pipe diameter 200 mm and length 5 m, delivery head 12 m, delivery pipe diameter 200 mm and length 18 m, coefficient of friction is 0.008, shaft power is 158 kW. Air vessels are connected on both suction and delivery sides near the pump (16)

(OR)

15 b)(i) What is indicator diagram? Also draw the diagram with effect of acceleration in suction pipe. (6)

(ii) A double acting reciprocating pump has piston of diameter 250 mm and piston rod of diameter 30 mm, which is on one side only. Length of piston stroke is 350 mm. and speed of crank moving the piston is 60 rpm. The suction and delivery heads are 4.5 m and 18 m. respectively. Determine the discharge capacity of the pump and power required to operate the pump. (10)

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