24/5/13

B.E. (Full Time) DEGREE END SEMESTER EXAMINATION, APRIL/MAY 2013

MECHANICAL ENGINEERING

THIRD SEMESTER - (REGULATION 2008)

CE 9211 - FLUID MECHANICS AND MACHINERY (English and Tamil Medium)

Time: 3 hours **Marks: 100**

Part – A **10 x 2 = 20**

Answer ALL questions

1. Define a fluid and solid.
2. What is control volume and give an example?
3. What is boundary layer and write its types of thickness?
4. What is Moody Diagram? State its use in pipe flow.
5. State Buckingham π theorem.
6. What is similarity in model study?
7. Differentiate between turbines and pumps.
8. How turbines are classified?
9. What is mean by 'multistage centrifugal pump'?
10. What is a reciprocating pump?

Part - B **5 x 16 = 80**

11. (i) A Newtonian fluid is filled in the clearance between a shaft and a concentric sleeve. The sleeve attains a speed of 50 cm/s, when a force of 40 N is applied to the sleeve parallel to the shaft. Determine the speed of the shaft, if a force of 200 N is applied. (6)

(ii) A U-tube differential manometer is connects two pressure pipes A and B, pipe A contains carbon tetrachloride having a specific gravity 1.5494 under a pressure of 11.772 N/cm^2 and pipe B contains oil of specific gravity 0.8 under a pressure of 11.772 N/cm^2. The pipe A lies 2.5m above pipe B. Find the difference of pressure measured by mercury as fluid filling U-tube. (10)

12. (a) Derive from basic principle Hagen Poiseuille equation for laminar flow through pipe line. (16)

(OR)

(b) In the boundary layer over the face of the spillway, the velocity distribution is observed to have the following form $u/U = (y/\delta)^{0.22}$

The free stream velocity U at a certain section is observed to be 30 m/s and a boundary layer thickness of 60 mm is also estimated at the section. The discharge (water of density 1000 kg/m^3) passing over the spillway is 6 m^3/s per m length of the spillway. Calculate

(i) displacement and energy thickness (12)

(ii) the loss of energy upon the section under consideration (4)

13. (a) Prove that the loss of pressure head for the viscous flow through a circular pipe is given by $h_f = (32\mu\bar{u}L)/(wd^2)$ where $\bar{u}$= average velocity ,w= specific weight (16)

(OR)

(b) In an aeroplane model of size 1/10 of its prototype the pressure drop is 7.5KN/m^2. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air is 1.4 kg / m^3, density of water is 1000 kg / m^3, viscosity of air is 0. 00018 poise and viscosity of water is 0.01poise. (16)

14. (a) (i) What is a draft-tube? What are its functions? (4)

(ii)The velocity of whirl at inlet to the runner of an inward flow reaction turbine is 3.15 $\sqrt{H}$ m/s and the velocity of flow at inlet is 1.05 $\sqrt{H}$ m/s. The velocity of whirl at exit is 0.22 $\sqrt{H}$ m/s in the same direction as at inlet and the velocity of flow at exit is 0.83 $\sqrt{H}$ m/s, where H is head of water 30 m. The inner diameter of the runner is 0.6 times the outer diameter. Assuming hydraulic efficiency of 80 %. Compute angles of the runner vanes at inlet and exit. (12)

(OR)

(b) A double jet Pelton wheel has a specific speed of 14 and is required to deliver 1000 kW. The turbine is supplied through a pipeline from a reservoir whose level is 400m above the nozzles. Allowing 5% for friction loss in the pipe calculate (1) Speed in rpm; (2) diameter of jet and (3) mean diameter of bucket circle. Take C_v = 0.98, Speed ratio = 0.46 and over all efficiency = 85%. (16)

15. (a) (i) A reciprocating pump has a suction head of 6 m and delivery head of 15 m. it has a bore of 150 mm and stroke of 250 mm and piston makes 60 double strokes in a minute. Calculate the force required to move the piston during (a) suction stroke, and (b) during the delivery stroke. Find also the power to drive the pump. (10)

(ii) Write short note on rotary pumps. (6)

(OR)

(b) (i) What is an air vessel? Describe the function of air vessel for reciprocating pump. (6)

(ii) Draw the indicator diagram and derive work done by the reciprocating pump. (10)