B.E (FULL TIME) DEGREE END SEMESTER EXAMINATION, APRIL/MAY - 2011

MECHANICAL ENGINEERING BRANCH

III SEMESTER - (REGULATION 2004)

CE 291 - FLUID MECHANICS AND MACHINERY

Time: 3 hours **Marks: 100**

Part – A **10 x 2 = 20**

Answer ALL questions

1. Define Specific weight and specific volume of a fluid.
2. Write the units and dimensions for viscosity and specific weight.
3. List out the types of flow?
4. What is Moody Diagram? State its use in pipe flow.
5. State Buckingham's π-theorem.
6. Define Froude number and Reynolds number?
7. What is Pelton Wheel turbine and draw its components?
8. Under what circumstance multistage centrifugal pump is preferable than pumps in parallel?
9. What is a reciprocating pump?
10. Define slip and negative slip of a reciprocating pump.

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

11. (i) What is Air vessel and where it can be fixed? **(4)**

    (ii)The cylinder bore diameter of a single acting reciprocating pump is 150mm. and its stroke length is 300mm. The pump runs at 50rpm and lifts water through a height of 25m. The delivery pipe is 22m long and 100mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 liters/s, find the percentage slip. **(12)**

12. (a) (i) Find the minimum size of glass tube that can be used to measure water level, if the capillary rise in the tube is to be restricted to 2 mm. Consider surface tension of water in contact with tube is 0.0738N/m. **(10)**

    (ii) Derive from fundamental dimensions the dimension of dynamic viscosity and kinematic viscosity? **(6)**

    (OR)

    (b) Derive Euler's equation of motion along a stream line and obtain Bernoulli's equation by its integration. State all assumptions made. **(16)**

13. (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 passing over the spillway is 6 m^3/s per m length of the spillway (water of density 1000 kg/m^3). Calculate;

(i) displacement and energy thickness **(12)**

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

14. (a) (i) Define dynamic similarity with suitable example? **(4)**

(ii) The pressure drop in an aero-plane model of size 1 / 10 of its proto type is 80 N/cm^2. The model is tested in water. Find the corresponding pressure drop in the proto type. Take density of air and water are 1.24 kg/m^3 and 1000 kg/m^3. The viscosity of air and water are 0.000018 Ns/m^2 and 0.001Ns/m^2 respectively. **(12)**

(OR)

(b) Using Buckingham π theorem. Show that the velocity through a circular orifice is given by $V= \sqrt{2gH}\, f(D/H, \mu / (\rho VH))$. Where H is head causing flow, d is diameter of orifice, $\mu$is coefficient of viscosity, ρ is mass density and g is acceleration due to gravity. **(16)**

15. (a) A centrifugal pump has an impeller of outer diameter 60 cm and inner diameter 20 cm. It is 2 cm wide at outlet and 5 cm wide at inlet. The blade angle at inlet and outlet are 20 degree and 10 degree respectively. The impeller rotates at 1800 rpm. Compute discharge for radial entry and power required to run the pump impeller. **(16)**

(OR)

(b) A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 0.7 m^3/s under a head of 30 m. The bucket deflects the jet through an angle of 160 degree. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98 **(16)**