(66)

B.E (FULL TIME) DEGREE END SEMESTER EXAMINATION, APRIL/MAY- 2012

MECHANICAL ENGINEERING (ENGLISH AND TAMIL)

III SEMESTER - (REGULATION 2008)

CE 9211 - FLUID MECHANICS AND MACHINERY

Time: 3 hours **Marks: 100**

Part – A **10 x 2 = 20**

Answer ALL questions

1. A liquid compressed in a cylinder has a volume of 1 litre at 1 MN/m^2 and a volume of 995 cm^3 at 2 MN/m^2. What is its bulk modulus of elasticity?
2. Define control volume.
3. When is the flow regarded as unsteady? Give an example for unsteady flow.
4. What is boundary layer? Give a sketch of a boundary–layer region over a flat plate.
5. State Buckingham's π-theorem.
6. Enlist the types of hydraulics similarities that should exist between model and its prototype.
7. Differentiate between impulse and reaction turbines.
8. What is mean by 'multistage centrifugal pump'? State its use.
9. Define slip of reciprocating pump and under what circumstances does the negative slip will occur?
10. List any three types of rotary pumps.

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

11. The efficiency η of a fan depends on density ρ, viscosity of fluid μ, angular velocity ω, diameter D of the rotor and the discharge Q. Derive an expression for η by dimensional analysis and show that, $\eta = \Phi [\mu/(D^2\omega\rho), Q/(D^3\omega)]$. **(16)**

12. (a) (i) A rectangular plate of size 25 cm X 50 cm and weighing 245.3 N slides down a 30 ° inclined surface at a uniform velocity of 2 m/s. If the uniform 2 mm gab between the plate and the inclined surface is filled with oil determine the viscosity of the oil. **(10)**

(ii) With neat sketch explain the phenomenon of surface tension and capillarity and write the necessary equation. **(6)**

(OR)

(b) 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. **(16)**

13. (a) Derive from basic principle the Euler's Equations of motion in Cartesian co-ordinate system and deduce the equation to Bernoulli's theorem for steady irrotational flow? **(16)**

(OR)

(b) (i) Derive Darcy-Weisbach equation for head loss due to friction in flow through pipe? **(8)**

(ii) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both sections of the pipe. **(8)**

14. (a) (i) What is breaking jet in Pelton wheel turbine? **(3)**

(ii) 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. **(13)**

(OR)

(b) (i) Sketch a typical layout of a centrifugal pump and indicate its various components. **(6)**

(ii) A centrifugal pump is to discharge 0.118m^3/s at a speed of 1450rpm against a head of 25m. The impeller diameter is 250mm and its width at the outlet is 50mm. If the manometric efficiency of the pump is 75%, determine the vane angle at the outer periphery of the impeller. **(10)**

15. (a) (i) Derive an expression for pressure head due to acceleration of the piston of a reciprocating pump, assuming motion of the piston to be S.H.M.

(OR)

(b) (i) Write short note on rotary pump. **(6)**

(ii) The cylinder bore diameter of a single acting reciprocating pump is 150 mm. and its stroke length is 300 mm. The pump runs at 50 rpm and lifts water through a height of 25m. The delivery pipe is 22 m long and 100 mm. in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres / s, find the percentage slip. Also determine the acceleration head at the beginning and middle of the delivery stroke. **(10)**