Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

MECHANICAL ENGINEERING

Third Semester

CE 8352 - FLUID MECHANICS AND MACHINERY

(Regulation 2012)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. 12 litres of a liquid of sp.gr. 1.3 is mixed with nine litres of a liquid of sp. gr. 0.8. If the bulk of the liquid shrinks 1% on mixing, calculate the sp.gr, the volume and the weight of the mixture.
2. Obtain an expression for capillary rise of a liquid.
3. State the assumptions made in Bernoulli's equation.
4. List the various types of losses in flow through pipes?
5. Name any four dimensionless numbers
6. What are all the types of similitude?
7. Distinguish the diffuser pump with other type of centrifugal pump with neat sketch.
8. Write the Euler's equation of hydrodynamics machines.
9. What is the significance of draft tube in reaction turbine?
10. Draw the velocity triangle for Pelton turbine when horizontal component of V_{r2} is less than u_2.

Part – B (5 x 16 = 80 marks)

11. (i) A 45^0 reducing pipe-bend in a horizontal plane, tapers from 500 mm diameter at the inlet to 250 mm diameter at the outlet. The pressure at the inlet is 137 kPa gauge and rate of flow of water through the bend is 0.425 m^3/s. Neglecting friction, calculate the net resultant horizontal force exerted by the water on the bend. Assume uniform conditions with straight and parallel streamlines at inlet and outlet and the fluid to be frictionless. (10)
(ii) A 30 cm x 15 cm venturimeter is inserted in a vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. Find the discharge and take coefficient of discharge as 0.98. (6)

12. a) The difference in water surface level in two tanks, which are connected by three pipes in series of lengths 300m, 170m and 210m and diameters 300 mm, 200 mm and 400mm respectively, is 12m. Considering all losses, determine the rate of flow if the co-efficient of friction is 0.005, 0.0052 and 0.0048 respectively. (16)

(OR)

b) Derive from basic principle, the Hagen Poiseuille equation for laminar flow through a circular pipe line.

13. a) Torque T exerted on the shaft of a turbine is found to be a function of diameter D, width B and speed N of the turbine runner, density ρ and viscosity μ of the water flowing in the turbine and difference of pressure P at inlet and outlet of the turbine. Obtain a functional relationship for T in terms of dimensionless parameters.

(OR)

b) (i) Determine the discharge through a weir model by knowing the discharge over the actual (proto type) weir is measured as 1.5 m^3/s. The horizontal dimension of the model is 1/50 times of the horizontal dimension of the prototype and the vertical dimension of the model is 1/10 times of the vertical dimension of the proto type. (10)

(ii) Derive any three dimensionless numbers. (6)

14. a) (i) What is an air vessel? Describe its function in reciprocating pumps. (6)

(ii) Determine the maximum speed at which a double acting reciprocating pump can be operated under the following conditions: (a) no air vessel on the suction side; (b) a very large air vessel on the suction side close to the pump. The suction lift is 4 m, length of suction pipe 6.5 m, diameter of suction pipe 100 mm, diameter of piston 150 mm and length of stroke is 0.45 m. Assume simple harmonic motion, atmospheric pressure head as 10.3 m for water and separation occurs at 2.45 m of water absolute. Take Darcy's friction factor = 0.014. (10)

(OR)

b) A three stage centrifugal pump has impeller of 40 cm in diameter and 2.5 cm wide at outlet. The vanes are curved back at the outlet at 30° and reduce the circumferential are by 15%. The manometric efficiency is 85% and overall efficiency is 75%. Determine the head generated by the pump when running at 12000 rpm and discharging 0.06 m^3/s. Also find shaft horse power.

15. a) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 120 cm and flow area is 0.4 m^2. The angles made by the obsolete and relative velocities at the inlet is 20° and 60° respectively with the tangential velocity. Determine (i) The volume flow rate (ii) The power developed (iii) Hydraulic Efficiency. Assume the whirl velocity at outlet is zero.

(OR)

b) (i) Derive an expression for the maximum efficiency of impulse turbine. (6)

(ii) A double jet impulse turbine has to develop 3000 kW at 400 rpm under a head of 270 m. if the overall efficiency is 0.90, determine the (1) diameter of the nozzle, (2) speed ratio, (3) specific speed. Take coefficient of velocity as 0.95 and diameter of runner as 1.5 m. (10)