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(31)

B. E / B. Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS Nov/Dec 2013

MECHANICAL ENGINEERING

THIRD SEMESTER

CE 8352 FLUID MECHANICS AND MACHINERY

(REGULATION 2012)

TIME: 3 hr Max Mark: 100

Answer ALL questions

PART – A (10 x 2 = 20 MARKS)

1. Classify the types of fluids.
2. Calculate the capillary rise in a glass tube of 2.5mm diameter when immersed vertically in (a) water and (b) mercury. Take surface tension σ=0.0725N/m for water and σ=0.52N/m for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact=130°.
3. Find the momentum thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$.
4. What are the different types of losses occurring in pipes?
5. Find the scale ratio for discharge in a distorted model.
6. What do you mean by repeating variables? How are the repeating variables selected for dimensional analysis?
7. What is priming of a centrifugal pump and why is it necessary?
8. What is an air vessel in reciprocating pumps?
9. Differentiate speed ratio and flow ratio in a turbine.
10. How can cavitation be avoided in a reaction turbine?

PART – B (5 x 16 = 80 Marks)

11. (i) Derive the Reynold's Transport theorem (8)

(ii) The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of oil film is 1.5mm. (8)

12. a (i) Derive the Hagen Poiseuille formula (16)

OR

b (i) Two tanks are connected with the help of two pipes in series. The lengths of the pipes are 1000m and 800m whereas the diameters are 400mm and 200mm respectively. The co-efficient of friction for both the pipes is 0.008. The difference of water level in the

two tanks is 15m. Find the rate of flow of water trough the pipes considering all the losses. Also draw the Hydraulic Gradient Line and Total Energy Line for the system. (16)

13. a (i) The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity v, viscosity μ, density ρ and roughness k. Using Buckingham's π theorem obtain an expression for Δp. (8)

a (ii) Define similitude and explain its types. (8)

OR

b (i) The pressure drop in an airplane model of size 1/50 of its prototype is 4N/cm2 . The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air = 1.24 kg/m3. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise. (8)

b (ii) Derive the five different types of dimensionless numbers. (8)

14. a (i) Derive the expression for pressure head due to acceleration in the suction and delivery pipes of the reciprocating pumps. (16)

OR

b (i) Find the power required to drive a centrifugal pump which delivers 0.04 m3/s of water to a height of 20m through a 15cm diameter pipe and 100m long. The overall efficiency of the pump is 70% and coefficient of friction f=0.15. (8)

b (ii) Draw and discuss the characteristic curves of centrifugal pumps. (8)

15. a (i) Describe the efficiencies of a turbine. (8)

a (ii) A Pelton wheel is to be designed for a head of 60m when running at 200rpm. The Pelton wheel develops 95.6475KW shaft power. The velocity of the buckets is 0.45 times the velocity of the jet. Overall efficiency is 0.85 and co-efficient of the velocity is 0.98. (8)

OR

b (i) A Francis turbine with an overall efficiency of 75% is required to produce 148.25kW power. It is working under a head of 7.62m. The peripheral velocity=$0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at 150rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge and determine

- The guide blade angle
- The wheel vane angle at the outlet
- Diameter of the wheel at inlet
- Width of the wheel at inlet (16)