

24259

B.Tech. 5th Semester (ME) Examination,

December-2015

FLUID MACHINE

Paper-ME-305-F

*Time allowed : 3 hours] [Maximum marks : 100*

*Note : Attempt five questions. Question No. 1 is compulsory and attempt at least one question from section.*

1. (a) Differentiate between turbines and pumps.
- (b) Define gross head and net head of Pelton wheel turbine.
- (c) Differentiate between radial and axial flow turbines.
- (d) Classify different types of pumps. 4×5

**Section-A**

2. (a) A Pelton Wheel turbine develops 10 MW under a net head of 140 m at a speed of 250 rpm. Assuming the coefficient of velocity for the nozzle as 0.99, hydraulic efficiency as 89%, Speed ratio as 0.45 and Jet diameter to wheel diameter ratio as 1/9, determine, (a) the discharge required, (b) the diameter of the wheel, (c) the diameter and number of jets required and (d) the specific speed. 15
- (b) Explain with neat sketch governing of pelton wheel turbine. 5

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3. (a) Obtain an expression for unit speed, unit discharge and unit power for a turbine. 8
- (b) Describe briefly the function of various main components of Pelton turbine with neat sketches. 12

#### Section-B

4. (a) A Kaplan turbine working under a head 25 m develops 16,000 kW shaft power. The outer diameter of runner is 4m and hub diameter is 2m. The guide blade angle is  $35^\circ$ . The hydraulic and overall efficiencies are 90% and 85% respectively. If velocity of whirl is zero at inlet. 10
- (b) What is draft tube ? Why is it used in a reaction turbine ? Describe with sketches two different types of draft tubes. 10

5. Explain construction, working principle, design parameters of Francis turbine with neat and clean diagram. 20

#### Section-C

6. (a) Define the following non dimensional numbers : Reynold's number, Froude's number and Mach's number. What are their significances for fluid flow problems ? 8
- (b) Describe the Rayleigh's method for dimensional analysis. 12

7. A radial, single stage, double suction, centrifugal pump is manufactured for the following data. 20  
 $Q = 80$  Litres / s,  $D_1 = 120$  mm,  $D_2 = 300$  mm,  $H_m = 40$  m,  $N = 1800$  rpm,  $b_1 = 25$  mm per side,  $b_2 = 23$  mm in total,  $\alpha_1 = 90^\circ$ , overall efficiency = 60%, Leakage loss = 2.25 Litres/s, Mechanical Loss = 1.04 Kw, ( $\beta_2 = 29^\circ$ ), Contraction factor due to vane thickness = 0.88.  
 Determine (a) The inlet vane angle (b) the angle at which the water leaves the wheel (c) Absolute velocity of water leaving impeller (d) The manometric.

#### Section-D

8. Explain Hydraulic lift and Hydraulic coupling in detail with clean diagram. 20
9. Explain the construction and working principle of Reciprocating and centrifugal pumps with neat and clean diagram. 20