December 2018
B.Tech - 4th Sem
Fluid Machines (MU-208)

Duration: 3 Hours **Max. Marks: 60**

Instructions:

- It is compulsory to answer all the questions of Part-1 in short.
- Answer any four questions from Part-2 in detail.
- Different sub-parts of a question are to be attempted adjacent to each other.
- Support your answer with neat sketches, wherever necessary.

PART 1

Q1 (a) Write the expression for the force exerted by a jet of water on an inclined fixed plate in the direction of the jet. (2)

(b) What do you mean by gross head and net head of turbine? (2)

(c) Define the term degree of reaction and what is its value for impulse turbine? (2)

(d) Differentiate between Kaplan and propeller turbine. (2)

(e) What are the uses of draft tube? (2)

(f) What is cavitation and what is its harmful effect. (2)

(g) Draw the constant efficiency curves of a centrifugal pump. (2)

(h) Differentiate between centrifugal pump and reciprocating pump. (2)

(i) Define slip and percentage slip of a reciprocating pump. (2)

(j) Draw a neat sketch of hydraulic crane. (2)

PART 2

Q2 (a) A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity=$0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at 150 r.p.m and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine: (i) The guide blade angle, (ii) The wheel vane angle at inlet, (iii) Diameter of the wheel at inlet, (iv) Width of the wheel at inlet. (5)

(b) With a neat sketch explain the construction and working of propeller turbine. (5)

Q3 A jet of water having a velocity of 35 m/s impinges on a series of vanes moving with a velocity of 20 m/s. The jet makes an angle of 30° to the direction of motion of vanes when entering and leaves at an angle of 120°. Draw the triangles of velocities at inlet and outlet and find: (a) the angles of vanes tips so that water enters and leaves without shock (b) the work done per unit weight of water entering the vanes (c) the efficiency (10)

Q4 (a) Define the term 'Governing of a turbine'. Describe with a neat sketch the governing of impulse turbine. (5)

(b) Explain the characteristic curves of hydraulic turbine. (5)

Q5 (a) Define specific speed and derive the expression for specific speed for a centrifugal pump. (5)

(b) With a neat sketch explain the working of a submersible pump. (5)

Q6 A single acting reciprocating pump has a plunger diameter of 250 mm and stroke of 450 mm and it is driven with S.H.M at 60 r.p.m. The length and diameter of delivery pipe are 60 m and 100 mm respectively. Determine the power saved in overcoming friction in the delivery pipe by fitting an air vessel on the delivery side of the pump. Assume friction factor=0.01 (10)

Q7 Write short notes on: (a) Hydraulic intensifier with a neat sketch (b) Buckingham's π-theorem (10)