EVENING

06 MAR 2024

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09]
Uni. Roll No. .....

[Total No. of Pages: 02]

Program: B.Tech. (Batch 2018 onward)
Semester: 4th
Name of Subject: Fluid Mechanics and Machinery
Subject Code: PCME-108
Paper ID: 16198

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

a) Define dynamic viscosity and kinematic viscosity.

b) Define streak line and the stream line. For what type of flow these lines are identical.

c) What do you understand by major and minor energy losses in pipes?

d) What is the use of air vessel in reciprocating pump?

e) How is Kaplan turbine different from a propeller turbine?

f) Why pumps are generally less efficient than turbines?

Part – B

[Marks: 04 each]

Q2. The pressure outside the droplet of water of diameter 0.05 mm is 1.0133 bar (atmospheric pressure). Calculate the pressure within the droplet if surface tension is given as 0.07 N/m of water.

Q3. A pipe of 250 mm diameter carries an oil of specific gravity 0.8 at the rate of 130 litres/s and under a pressure of 3 kPa. Find the total energy per unit weight at a point which is 3 m above the datum line. Find also the total energies per unit mass and per unit volume.

Q4. Derive Darcy's equation for head loss due to friction in pipes.

Q5. Two jets strike the buckets of a Pelton wheel, which is having shaft power as 15450 kW. The diameter of each jet is 200 mm. If the net head on the turbine is 400 m, find the overall efficiency of the turbine. Take $C_v = 1.0$.

Q6. Draw and explain main and operating characteristic curves for water turbine.

Q7. Make a neat sketch of centrifugal pump installation showing the pressure gauges and other necessary fittings.

Part – C

[Marks: 12 each]

Q8. Obtain an expression for Continuity equation in 3-D Cartesian co-ordinate system.

OR

The maximum power is to be transmitted through a pipeline. Workout the conditions for maximum transmission of power. It is desired to develop 1000 kW of power at 85 % efficiency by supplying water to a hydraulic turbine through a horizontal pipe 500 m long. Determine the necessary flow rate and minimum diameter of pipe to carry that discharge. Water is available at a head of 150 m. Take f = 0.006 in the formula.

$$h_f = 4\, f\, l\, v^2 / d\, 2g$$

Q9. Draw a neat and clean diagram of Francis turbine. Also explain its components and working.

OR

A centrifugal pump has an impeller of 80 cm in diameter and it delivers 1 m^3/s against a head of 80 m. The impeller runs at 1000 rpm and the width at outlet is 8 cm. If the leakage loss is 3 % of the discharge, external mechanical loss is 10 kW and the hydraulic efficiency is 80 %, calculate the blade angle at outlet, the power required and overall efficiency of the pump.

****