4E1310

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4E1310

B. Tech. IV - Sem. (Main / Back) Exam., - 2025

Automobile Engineering

4AE4-05 Fluid Mechanics and Fluid Machines

AE, ME

Time: 3 Hours **Maximum Marks: 70**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

[10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1 Define density and specific gravity.

Q.2 Explain the variation of viscosity with temperature.

Q.3 What is free vortex and forced vortex flow?

Q.4 Define energy and momentum correction factor.

Q.5 What are the factors influencing the frictional loss in pipe flow?

Q.6 What is the expression for head loss due to friction in Darcy formula?

Q.7 State Froude's dimensionless number.

Q.8 How are hydraulic turbines classified?

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Q.9 What is meant by cavitation in turbines?

Q.10 Definition of heads and efficiencies of a centrifugal pump.

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Prove that the pressure is exerted equally in all direction at any point in a liquid at rest.

Q.2 Find the displacement thickness and wall shear stress for the velocity distribution in a boundary layer $(u/U) = (y/\delta)$ where U is the Velocity and δ is the boundary layer thickness.

Q.3 Derive Darcy-Weisbach equation for calculating pressure drop in a pipe.

Q.4 What is an air vessel? Describe the function of the air vessel for reciprocating pump with neat sketch.

Q.5 What is the importance of a draft tube in a Francis turbine? Discuss different types of draft tubes.

Q.6 Explain various types of impellers used in centrifugal pump.

Q.7 With a neat sketch, explain the construction and working of Pelton wheel.

PART – C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 An inverted U-tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35cm. Determine the difference of pressure between the pipes.

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Q.2 Derive the expression for flow through pipes in series and parallel. Also write about Hydraulic Gradient Line and Total Energy Line.

Q.3 Explain the principle of orifice meter and derive the equation to find the rate of flow of water through a pipe using the same.

Q.4 A single acting reciprocating pump has plunger of diameter 250mm and stroke of 350mm. if the speed of the pump is 60 is r.p.m. and it delivers 16.5 litres per second of water against a suction head of 5m and a delivery head of 20m, find the theoretical discharge, coefficient of discharge, the slip, the percentage slip of the pump and the power required to drive the pump.

Q.5 A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62m. The peripheral velocity = $0.26\sqrt{2gh}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gh}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine:

(a) The guide blade angle

(b) The wheel vane angle at inlet

(c) Diameter of the wheel at inlet

(d) Width of the wheel at inlet

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