

Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

EVENING

[Total No. of Questions:09]

[Total No. of Pages:02]

Uni. Roll No.

30 JUN 2022

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) What is dynamic viscosity and kinematic viscosity?
- b) State Bernoulli equation and list its practical applications.
- c) State the advantages and disadvantages of a Francis turbine over a Pelton wheel.
- d) What is cavitation and priming?
- e) Give the comparison between impulse and reaction turbines.
- f) Distinguish between path lines, stream lines and streak lines.

Part – B

[Marks: 04 each]

Q2. Two large fixed parallel planes are 12 mm apart. The space between the surfaces is filled with oil of viscosity 0.972 Ns/m^2 . A flat thin plate 0.25 m^2 area moves through the oil at a velocity of 0.3 m/s . Calculate the drag force.

- (i) When the plate is equidistant from both the planes, and
- (ii) When the thin plate is at a distance of 4 mm from one of the plane surfaces.

Q3. Given the velocity field:

$$V = (6 + 2xy + t^3)i - (xy^2 + 10t)j + 25k$$

What is the acceleration of a particle at $(3, 0, 2)$ at time $t = 1$

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- Q4. The dynamic viscosity of 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 90 mm. The thickness of the oil film is 15 mm.
- Q5. Classify different types of pumps and define slip, percentage slip and negative slip of reciprocating pump.
- Q6. Draw a schematic diagram of a Francis turbine and explain its construction briefly and working.
- Q7. State and Prove Bernoulli's Equation for real fluids.

Part – C

[Marks: 12 each]

Q8. Discuss the following questions in detail

- Major energy loss and minor energy losses in pipes.
- How will you determine the loss of head due to friction in pipes by using (i) Darcy Formula and (ii) Chezy's formula?

OR

Discuss the following in detail

- Newton's law of viscosity.
 - Relation between stream function and velocity potential function.
- Q9. The water available for a Pelton wheel is $4 \text{ m}^3/\text{s}$, and the total head from the reservoir to the nozzle is 250 m. The turbine has two runners with two jets per runner. All the four jets have the same diameters. The pipe is 3 km long. The efficiency of transmission through the pipeline and the nozzle is 91%, and the efficiency of each runner is 90%. The velocity co-efficient of each nozzle is 0.975, and the coefficient of friction '4f' for the pipe is 0.0045.

OR

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 .
