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18MT42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fluid Mechanics and Machines

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a.   Define following properties of fluid :
   i)   Density
   ii) Specific weight
   iii) Specific gravity
   iv) Viscosity
   v)   Cavitation   **(10 Marks)**
   b.   List common types of simple manometers. Explain any one of them in brief.   **(05 Marks)**
   c.   The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190rpm. Calculate the power lost in the bearing for sleeve length of 90mm. The thickness of oil film is 1.5mm.   **(05 Marks)**

OR

2   a.   Obtain an expression of center of pressure for an inclined surface submerged in liquid.   **(10 Marks)**
   b.   Determine the total pressure on a circular plate of diameter 1.5m which is placed vertically in water in such a way that the centre of plate is 3m below the free surface of water. Find the position of centre of pressure also.   **(10 Marks)**

Module-2

3   a.   Explain different types of fluid flow.   **(10 Marks)**
   b.   The velocity potential function is given by $\phi = 5(x^2 - y^2)$. Calculate velocity components at the point (4, 5).   **(10 Marks)**

OR

4   a.   Derive Euler's equation of motion? And state the assumption made by Bernoulli's.   **(10 Marks)**
   b.   Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom and is 24.52N/cm^2 and the pressure at the upper end is 9.81N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s.   **(10 Marks)**

Module-3

5   a.   Define :
   i)   Derived quantities
   ii) Dimensional homogeneity
   iii) Buckingham's Pi theorem
   iv) Similitude.   **(08 Marks)**
   b.   Performance of a turbine depends on the following variables. Discharge (ϕ), Speed(N), Size or rotor diameter (D), Energy per mass flow (gH), Power(P), Density of water (ρ), Dynamic viscosity of fluid (μ). Use dimensional analysis to obtain the Pi-numbers?   **(12 Marks)**

OR

6 a. Derive an expression for actual discharge through a venturimeters flow measuring device? **(10 Marks)**

b. A orifice meter with an orifice diameter 10cm is inserted in a pipe of 20cm diameter. The pressure gauge fitted upstream and down steam of the orifice meter gives readings of $19.62 N/cm^2$ and $9.81 N/cm^2$ respectively co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through the pipe? **(10 Marks)**

Module-4

7 a. Define turbomachines. Distinguish between turbomachines and positive displacement machines. **(10 Marks)**

b. Describe the general classification of turbomachines. **(10 Marks)**

OR

8 a. Derive alternate form of Euler turbine equation with suitable velocity diagram. **(12 Marks)**

b. Define the degree of reaction and utilization factor by writing mathematical equation. **(08 Marks)**

Module-5

9 a. Derive an expression for maximum efficiency of a pelton wheel turbine. **(12 Marks)**

b. What are the functions of the draft tube? List different types of draft tube along with the diagrams. **(08 Marks)**

OR

10 a. What are the methods of compounding? Explain any one method in brief. **(08 Marks)**

b. Derive a condition for maximum blade efficiency of an impulse turbine with equi-angular blades. **(12 Marks)**

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