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[Total No. of Pages : 03

B. Tech. (Sem. - 4th)

FLUID MECHANICS - I

SUBJECT CODE : ME - 206

Paper ID : [A0810]

[Note : Please fill subject code and paper ID on OMR]

...= 03 Hours

Maximum Marks : 60

...tion to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

(10 × 2 = 20)

a) Discuss classification of fluids.

b) What are differential manometers?

c) Define the horizontal and vertical components of hydrostatic force acting on a submerged curved surface?

d) Describe experimental method of determining the metacentric height of a ship model.

e) Explain the methods of describing fluid motion.

f) Prove streamlines and equipotential lines form a net of mutually perpendicular lines.

g) What is the significance of kinetic and momentum correction factors in the analysis of fluid flow?

h) What are the various dimensionless numbers? Mention the flow situations where each of these numbers is significant.

i) Define hydraulic gradient line and total energy line with the help of a diagram.

j) Explain the principle of Pitot tube.

Section - B

(4 × 5 = 2

Q2) A disc of 100 mm diameter is rotating at 100 rpm on another station_y di of same diameter. The space between the two discs is separated by an film of thickness 1.5 mm. Determine power dissipated if viscosity of oil 80 cP.

Q3) A cylinder of diameter 300 mm and height 1m is fixed centrally on the top another large cylinder of diameter 1 m and height 600 mm. Both the cylind are filled with water.
Calculate

(a) Total pressure force at the bottom of the large cylinder.

(b) Total weight of water in the cylinders and compare it with the res obtained in (a). Explain the difference, if any.

Q4) A velocity field is given as: $V = (y^3 + 6x - 3x^2y)i + (3xy^2 - 6y - x^3)j$. Che whether the flow is

(a) Continuous.

(b) Irrotational and.

(c) If irrotational, find stream function.

Q5) A 100 diameter orifice discharges 40 litres per sec of water under a head 3.2 m. A flat plate held normal to the jet just downstream from the orifi requires a force of 300 N to resist the impact of jet. Find hydraulic coefficien of orifice.

Q6) The power P required to drive a propeller is known to depend on diameter and angular velocity ω of the impeller; density ρ, viscosity μ and bu modulus of elasticity K of the fluid. Derive a functional relationship for P dimensionless form using Buckingham method of analysis.

Section - C

(2 × 10 = 20)

Q7) A sudden horizontal transition in a 300 mm diameter pipe reduces the diameter to 150 mm. Velocity measurement indicated kinetic energy correction factor (α) and momentum correction factor (β) at 300 mm section to be 1.90 and 1.30, respectively. The corresponding values of α and β at 150 mm section are 1.15 and 1.05, respectively. If pressure and average velocity at 150 mm section are 15kPa and 6 m/s respectively, Calculate the resultant force on the transition due to flow of water in the transition. The coefficient of contraction may be taken as 0.65.

Q8) A pipe of diameter 100 mm and length 1 km is used to pump oil into a tank at the rate of 1.2 m^3/min. The first 300 m of pipe is laid upward at an angle of 10° to the horizontal and the remaining pipe is laid upward 15° to the horizontal. Determine the pressure to be developed by the pump and power of driving motor if pump efficiency is 60%. The viscosity and specific gravity of oil are 0.85 Ns/m^2, 0.92, respectively.

Q9) An old pipeline 200 mm in diameter and 4 km long connects two reservoirs having difference of water levels as 18 m. In order to increase discharge to the lower reservoir, the alternatives suggested are:

(a) Old pipe is replaced by a new pipe of diameter 250 mm and

(b) A new pipe 250 mm in diameter is provided for the first half distance and the old pipes are provided in parallel for the remaining distance. Find percentage increase in discharge for both the cases. Neglect minor losses of energy and take coefficient of friction as 0.009 for the old pipe and 0.0075 for the new pipe.