K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:III
Class:SY	Program:B.Tech
Branch Code:MEC	Pattern:2022
Name of Course:Fluid Mechanics	Course Code:MEC222002
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains _____page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

1	Define: 1) Specific Weight 2) Specific gravity 3) Viscosity 4) Surface tension 5) Vapour pressure 6) Compressibility	(6)	CO1

Question No. 2 Attempt following Question

2	The stream function for a two-dimensional flow is given by $\psi = 2xy$, calculate the velocity at point P (1,2)	(6)	CO3

Question No. 3 Attempt following Question

3.a)	An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. calculate the discharge of oil through the horizontal venturimeter. Take C_d=0.98	(6)	CO1, CO3

OR

3.b)	In a100 mm diameter horizontal pipe a venturimeter of 0.5 contraction ratio has been fixed. The head of water when there is no flow is 3m(gauge).Find the rate of flow for which the throat pressure will be 2meters of water absolute .The coefficient of discharge is 0.97.Take atmospheric pressure head =10.3 m of water	(6)	CO1, CO3
3.c)	The drag force on a smooth sphere is found to be affected by the velocity of flow V, the diameter D of the sphere and the fluid properties density ρ and viscosity μ. Using dimensional analysis obtain the dimensionless groups to correlate the parameters.	(6)	CO1, CO3

OR

3.d)	The pressure difference Δp in a pipe of diameter D and length l due to turbulent flow depends on the velocity V ,viscosity μ and density ρ .Using Buckingham's Π –theorem obtain an expression for Δp	(6)	CO1, CO3

3.e) Explain with neat sketch the pitot tube and it's applications. (4) CO3

OR

3.f) Explain orificemeter with neat sketch (4) CO3

Question No. 4 Attempt following Question

4.a) An oil of specific gravity 0.9 and viscosity 0.006 Ns/m^2 is flowing through a pipe of diameter 200 mm at a rate of 60 Litres/sec. Find the head loss due to friction for a 500 m length of pipe. Fine the power required to maintain the flow. Use $f = \frac{0.079}{Re^{0.25}}$ if flow is turbulent (6) CO1, CO3, CO4

OR

4.b) Water at 10°C (ρ= 999.7 kg/m^3 and μ= 1.307 x 10^{-3} kg/m ·s) is flowing steadily in a 4 cm diameter, 15 m long pipe at an average velocity of 7.2 m/s. Determine: a) the head loss, and (d) the pumping power requirement to overcome this head loss. use $f = \frac{0.079}{Re^{0.25}}$ if flow is turbulent (6) CO1, CO3, CO4

4.c) A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 15 m. The length of the syphon is 600 m and the summit is 4 m above the water level in the upper reservoir. The separation takes place at 2.8 m of water absolute. Find the maximum length of the syphon from upper reservoir to the summit. Neglect minor losses. Take co-efficient of friction, f = 0.004. The Atm. pressure is 10.3 m of water (6) CO1, CO3, CO4

OR

4.d) The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2. Determine : (6) CO1, CO3, CO4

i) loss of head due to sudden enlargement

ii) pressure intensity in the large pipe

4.e) Draw and explain the Shear stress and velocity distribution across the section for a fully-developed laminar flow of viscous fluid through the circular pipe (4) CO4

OR

4.f) Define hydraulic gradient line(HGL) & total energy line (TEL) (4) CO4

Question No. 5 Attempt following Question

5.a) Find the difference in drag force exerted on a flat plate of size 2 m X 2 m when the plate is moving at a speed of 4 m/s normal to its plane in: i) water, ii) air of density 1.24 kg/m^3. Coefficient of drag is given as 1.15 (6) CO1, CO5

OR

5.b) A man weighing 981 N descends to the ground from an aeroplane with the help of a parachute against the resistance of air. . The shape of the parachute is hemispherical of 2 m diameter. Find the velocity of parachute with which it comes down. Assume C_d=0.5 and density of air 0.00125 gm/$cm^3$and kinematic viscosity 0.015 stokes. (6) CO1, CO5

5.c) A kite 0.8 m X 0.8 m weighing 3.9 N assumes an angle of 12^o to the horizontal. The string attached to the kite makes an angle of 45^o to the horizontal. The pull on the string is 24.52 N; when the wind is blowing at a speed of 30km/hr. Find the corresponding coefficient of drag and lift. Density of air is given as 1.25 kg/m^3 (6) CO1, CO5

OR

5.d)	A jet plane which weighs 29.43 kN and having a wing area of 20 m^2 flies at a velocity of 950 km/hour, when the engine delivers 7357.5 kW power. 65% of the power is used to overcome the drag resistance of the wing. Calculate the coefficient of lift and drag for the wing. Air density = 1.21 kg/m^3	(6)	CO1, CO5
5.e)	Write a short note on "boundary layer formation over a flat plate.	(4)	CO5
	OR		
5.f)	What is drag? What causes it? Why do we try to minimize it?	(4)	CO5

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