R22 Regulation *Subject code:4E3AC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech III Semester Regular/Supplementary Examinations, December 2025

FLUID MECHANICS

(CE)

Maximum Marks: 60 Date:19.12.2025 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x1M=10 Marks)		Marks	CO	BTL
1a)	Compare specific weight and specific volume.	1M	1	L4
b)	Name the devices that are used to measure the pressure of a fluid.	1M	1	L1
c)	Write the properties of stream function.	1M	2	L3
d)	Define "vortex flow".	1M	2	L1
e)	What is the principle involved in venturi meter?	1M	3	L1
f)	Differentiate between small and large orifice.	1M	3	L2
g)	Differentiate major and minor head loss.	1M	4	L2
h)	What is meant by equivalent length?	1M	4	L1
i)	List out the conditions for separation of boundary layer.	1M	5	L1
j)	Differentiate between laminar boundary layer and turbulent boundary layer.	1M	5	L2

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	A differential manometer is connected to two pipes whose centres are at 3 m difference in height. Higher level pipe is carrying liquid of specific gravity of 0.9 at a pressure of 1.8 bar and another pipe is carrying liquid at specific gravity of 1.5 at a pressure of 1 bar. The centre of pipe carrying low pressure liquid is 2 m above the higher level of the mercury in the manometer. Find out the difference in mercury level in the manometer in cm.	10M	1	L3
	OR			
3	a) Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. b) Define viscosity. Explain Newton's law of viscosity.	5M 5M	1 1	L4 L2
4	a) The stream function for a flow is given by $\Psi = 2xy$. Calculate the resultant velocity at P(3,4). Also find the velocity potential function ϕ.	5M	2	L3

	b) Derive continuity equation from principle of conservation of mass.	5M	2	L2
	OR			
5	a) If for a two – dimensional potential flow, the velocity potential is given by $\phi = x(2y-1)$,determine the velocity at the point P(4,5). Determine also the value of stream function Ψ at the point P. b) Explain the concept of meta-centre (M), metacentric height (GM), and their significance in the stability of floating bodies.	5M 5M	2 2	L3 L2
6	Derive Euler's equation of motion for flow along a stream line. What are the assumptions involved.	10M	3	L3
	OR			
7	a) A 20 cmx10 cm venturi meter is inserted in a vertical pipe of carrying oil of specific gravity 0.8. The flow of oil is an upward direction. The difference of levels between the throat and inlet section is 50 cm. The oil mercury differential manometer gives a reading of 30 cm of mercury. Find the discharge of oil. Neglect losses. b) A pipe carries a flow of an oil of Relative Density = 0.85. A pitot-static tube is inserted into the pipe to measure the velocity at a point A. If a differential mercury-oil gauge connected to the pitot-static tube indicates a reading of 4cm, calculate the velocity at A. Assume the coefficient of the pitot tube as 0.99.	5M 5M	3 3	L3 L3
8	a) What do you understand by total energy line, hydraulic gradient line, pipes in series, pipes in parallel, and equivalent pipe. b) Two pipes of diameter 400mm and 200mm are each 300m long. When the pipes are connected in series the discharge through the pipeline is $0.10 m^3/sec$, Estimate the loss of head incurred. What would be the loss of head in the system to pass the same total discharge when the pipes are connected in parallel? Take friction factor = 0.0075 for each pipe.	5M 5M	4 4	L2 L4
	OR			
9	Derive the Hagen–Poiseuille equation for laminar flow.	10M	4	L3
10	a) What is a boundary layer? Differentiate between a laminar and turbulent boundary layer b)A flat plate of 2 m width and 5 m length is kept parallel to air flowing at 4 m/s velocity. Measure i) The length of the plate over which the boundary layer is laminar ii) Boundary layer thickness iii) Shear stress Take density = $1.2 kg/m^3$ and kinematic viscosity as $1.4 \times 10\text{-}5 m^2/s$.	5M 5M	5 5	L2 L3
	OR			
11	Explain the formation of boundary layer along a thin flat plate.	10M	5	L3