R22 Regulation *Subject code: 4E3AC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech III Semester Supplementary Examinations, June 2026

FLUID MECHANICS

(CE)

Maximum Marks: 60 Date:16.06.2026 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)	Distinguish between gauge pressure and vacuum pressure	1M	1	L2
b)	Write down the expression for capillary fall in terms of surface tension for mercury.	1M	1	L3
c)	What is a pathline? How does it differ from a streamline?	1M	2	L3
d)	Give one example each of laminar and turbulent flow.	1M	2	L1
e)	What is the principle involved in pitot tube	1M	3	L1
f)	How does gravity act as a body force in fluids?	1M	3	L3
g)	What are the factors influencing the frictional loss in pipe flow?	1M	4	L1
h)	What is Hagen Poiseuille's formula?	1M	4	L1
i)	Give one example of turbulent boundary layer flow.	1M	5	L1
j)	What is Magnus Effect?	1M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) Define the following fluid properties: Density, weight density, specific volume and specific gravity of a fluid.	5M	1	L1
	b) A circular plate 3.0 m diameter is immersed in water in such a way that the plane of the plate makes an angle of 60° with the free surface of water. Determine the total pressure and position of center of pressure when the upper edge of the plate is 2m below the free water surface.	5M	1	L3
	OR			
3	a) A plate of 1mm thick and 120 cm^2 is placed at midway between two parallel plates spaced at 7mm apart. The space above the central plate is filled with fluid of viscosity twice when compared to that of the fluid filled in the lower half. What is the viscosity of the fluid in the lower half if the central plate requires a force of 0.4 N to move it at 2m/s.	5M	1	L3
	b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the	5M	1	L3

	vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15 cm below.			
4	a) Discuss the properties of stream function and velocity potential function. Show that if a velocity potential exists, the flow must be irrotational. b) If for a two dimensional potential flow, the velocity potential function 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	5M 5M	2 2	L2 L3
	OR			
5	a) Explain the concepts of circulation and vorticity. Derive the mathematical expressions for both in two-dimensional flow. b) The velocity component for a two-dimensional incompressible flow are given by $u = 3x - 2y$ and $v = -3y - 2x$. Show that the velocity potential exists. Determine the velocity potential function and stream function.	5M 5M	2 2	L2 L3
6	a) Derive the Bernoulli's equation from Euler's equation. State the assumptions made. b) A 300 mm diameter pipe carries water under a head of 20 meters with a velocity of 3.5 m/s.If the axis of the pipe turns through 45°, find the magnitude and direction of the resultant force at the bend.	5M 5M	3 3	L4 L3
	OR			
7	a) A venture meter of inlet diameter 300mm and throat diameter 150mm is inserted in vertical pipe carrying in the upward direction. A different mercury manometer connected to the inlet and throat gives a reading of 200mm. Find the discharge if the coefficient of discharge of meter is 0.98 b) Derive an expression for discharge over a broad crested weir.	5M 5M	3 3	L3 L4
8	a) 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. b) Explain the Reynold's experiment to classify the flows.	5M 5M	4 4	L4 L2
	OR			
9	a) Derive an expression for the Darcy Weis Bach equation. b) A pipe line 30 cm in diameter 1500 m long is used to connect two tanks and has a slope of 1 in 100. The water level in the first tank is 10 m above inlet of the pipe and water level in the second tank is 2 m above the outlet of the pipe. Considering only frictional losses, find the flow rate through the pipe. Also draw TEL and HGL lines. Take friction factor as 0.005.	5M 5M	4 4	L4 L3

10	a) What do you understand by Boundary Layer? Explain the development of Boundary layer over a flat plate. b) Analyze an expression for a drag force on a flat plate due to boundary layer.	5M 5M	5 5	L2 L4
	OR			
11	a) Calculate the friction drag on a flat plate 15cm wide and 45cm long placed longitudinally in a stream of oil of relative density 0.925 and kinematic viscosity 0.9 stoke, flowing with a free stream velocity of 6.0 m/s. Also, find the thickness of the boundary layer and shear stress at the trailing edge. b) Define drag and lift. Explain how boundary layer separates from the boundary.	5M 5M	5 5	L3 L2