R22 Regulation *Subject code: 4E3AC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech III Semester Regular Examinations, February 2024

Fluid Mechanics

(Civil Engineering)

Maximum Marks: 60 Date: 21-02-2024 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	CO	Bloom Tx
All the following questions carry equal marks	(10x1M=10 Marks)		
1.a)	Define kinematic viscosity.	1	L1
b)	Calculate the specific volume of 1 litre of liquid which weighs 7.2 N	1	L2
c)	What is stream function ψ?	2	L1
d)	Distinguish between stream line and streak line.	2	L1
e)	List the specific applications of Bernoulli theorem.	3	L2
f)	Write Euler's equation.	3	L1
g)	Give the values of Reynold's number for laminar and turbulent flow.	4	L2
h)	List the types of losses in a pipe flow	4	L1
i)	What is laminar sub-layer?	5	L1
j)	List the methods of preventing the separation of a boundary layer.	5	L2
	Part-B		
Answer All the following questions.	(5X10M=50Marks)		Bloom Tx
2	A. Explain the working of an inverted U tube manometer with a neat sketch. (5) B. A flat plate of area 1.2 x 10^6 mm^2 is pulled with a speed of 0.4 m/s relative to another plate located at a distance of 0.14 mm from it. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity of 1.1 poise. (5)	1	L3 L4
	OR		
3	A. Define surface tension. Prove that the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by $p=(4\sigma/d)$. (5) B. Calculate the capillary effect in mm in a glass tube of diameter 4 mm, when immersed in (i) water (ii) mercury, if the temperature of the liquid is 22°C and the corresponding value of the surface tension of water and mercury at 22°C in contact with air are 0.0735 N/m and 0.5111 N/m respectively. The angle of contact for water is zero and that for mercury is 130°. Take density of water as equal to 997 Kg/m^3. (5)	1	L3 L4
4	A fluid flow field is given by $V = (x^2y)i + (y^2z)j - (2xyz + yz^2)k$. Prove that it is	2	L4

	a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2,1,3). (10)		
	OR		
5	Derive the continuity equation in three dimensions. (10)	2	L3
6	State Bernoulli theorem for steady flow of incompressible fluid. Derive an expression for Bernoulli equation from first principle and state the assumption made in derivation. (10)	3	L4
	OR		
7	A 300 mm × 150 mm Venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, the flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300 mm. The differential U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate: (i) The discharge of oil (ii) The pressure difference between the entrance section and throat section. Take the co-efficient of meter as 0.98 and specific gravity of mercury as 13.6. (10)	3	L4
8	Derive the Hagen Poiseiulle equation for laminar flow of fluid in a circular pipe with proper assumptions and neat sketch. (10)	4	L3
	OR		
9	The difference in water surface levels in two tanks is 12 m. They are connected by three pipes in series of lengths 300 m, 170 m & 210 m and the diameters 300 mm, 200 mm & 400 mm respectively. Determine the rate of flow, if coefficient of friction is 0.005, 0.0052 & 0.0048 respectively, Considering the (i) Minor Losses (ii) Neglecting minor losses. (10)	4	L4
10	A. Describe the characteristics of boundary layer with reference to flow over a thin flat plate. (6) B. Write a note on Magnus effect and its significance. (4)	5	L3 L2
	OR		
11	A thin plate (length- 40 cm and width- 25 cm) is moving in still atmosphere at velocity of 4.4 m/s. Find the following: (i) thickness of boundary layer at the end of plate (ii) drag force on one side of plate. Assume the density of air as 1.2 kg/m^3 and kinematic viscosity as 0.15 stokes. (10)	5	L4