Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1		Attempt any FOUR	[20]
	a	Explain Newtonian and non-Newtonian Fluids	[5]
	b	Explain velocity potential function and stream function.	[5]
	c	What are the Applications of Bernoulli's equation in Orifice meter, Venturi meter, Rotameter and Pitot tube	[5]
	d	Define Reynolds number. Explain critical Reynolds number for flat plate and pipe conduit.	[5]
	e	Explain various Major and Minor losses for flow through pipe	[5]
	f	Explain Streamlined and bluff bodies	
2	a	The flow field is given by $V= xyi + 2yz\ j - (yz+z^2)\ k$ i) Show that it represents a possible 3-D steady incompressible continuous flow ii) Is this flow rotational or irrotational? If rotational determine at the point (2,4,6) a) angular velocity,b) vorticity, c) shear strain, and d) Dilatency	[10]
	b	Derive an expression for total pressure and centre of pressure for a vertically immersed surface.	[10]
3	a	What is venturimeter? Derive expression of discharge through venturimeter.	[10]
	b	360 lit/sec of water is flowing in pipe. The pipe is bent by 120^0. The pipe bend measures 360 mm x 240 mm and volume of the bend is 0.14 m^3. The pressure at the entrance is 73 KN/m^2 and the exit is 2.4m above the entrance. Find the direction and magnitude of resultant force.	[10]
4	a	A liquid of viscosity of 0.9 poise is filled with horizontal plates 10 mm apart. If the upper plate is moving at 1 m/s with respect to the lower plate which is stationary and pressure difference between two sections 60m apart is 60 kN/m^2. **Determine** i) The velocity distribution ii) The discharge per unit width iii) The shear stress on upper plate.	[10]
	b	Derive Euler's equation of motion in rectangular Cartesian co-ordinate system and from this derive Bernoulli's Equation for liquid. State assumptions made in the derivation of Bernoulli's Equation	[10]
5	a	Derive the Hagen-poiseuille Equation.	[10]
	b	Water is flowing through a pipe having diameter 600 mm and 400 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 350 kN/m^2 and the pressure at upper end is 100 kN/m^2. Determine the difference in datum head if the rate of flow through the pipe is 60 litre/sec.	[10]

9567D34F33550E7EAAD8605AA40F8C87

6 a Two reservoirs with a difference in elevation of 15m are connected by the three pipes in series. The pipes are 300 m long of diameter 30 cm, 150 m long of 20cm diameter and 200 m long of 25 cm diameter respectively. The friction factors for three pipes are 0.018, 0.020 and 0.019 respectively and which account for friction and all losses. **Determine** the flow rate in lit/sec. The loss of coefficient for sudden contraction for dia.30 cm to 20 cm is equal to 0.24. [10]

b Using the laminar boundary velocity distribution: [10]

$$\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$$

(i) Determine boundary layer thickness in terms of Re

(ii)Check if boundary layer separation occurs

****

9567D34F33550E7EAAD8605AA40F8C87