BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BTECH **SEMESTER : VI**
BRANCH: CHEMICAL ENGINEERING **SESSION : SP/2025**

SUBJECT: CL371 COMPUTATIONAL FLUID DYNAMICS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Navier-Stokes equation cannot be solved explicitly. Demonstrate the reason mathematically.	[2]	1	4
Q.1(b)	Identify the carrying velocity and flux in the following terms as given below: $\frac{\partial(uv)}{\partial x}$, $\frac{\partial(uv)}{\partial y}$, $\frac{\partial(vT)}{\partial x}$	[3]	1	5
Q.2(a)	What is the transportive property of a scheme?	[2]	3	1
Q.2(b)	Prove that the central discretization scheme does not possess transportive property.	[3]	2	3
Q.3(a)	What is the 2nd Upwind scheme?	[2]	2	2
Q.3(b)	What is the time-marching of error in explicit equations?	[3]	2	2
Q.4(a)	What is a staggered grid?	[2]	2	2
Q.4(b)	Demonstrate how the Navier-Stokes equation can be solved using a staggered grid.	[3]	1	3
Q.5	Heat conduction takes place in a one-dimensional metal rod of length 0.5 m. The two ends of the rod are exposed at temperatures 100°C and 500°C, respectively. The thermal conductivity of the material is 1000 W/m.K, and the cross-sectional area is 0.01 m^2. Divide the rod into 5 equal nodes and form a matrix to identify the steady-state temperature distribution by applying the numerical discretization technique.	[5]	2	3

::::::27/02/2025::::::E