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

CLASS: B.TECH. **SEMESTER : V**
BRANCH: MECHANICAL **SESSION : MO/2025**

SUBJECT: ME353 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)	Explain conservative and non-conservative models of flow.	[2]	1	II
Q.1(b)	Explain the physical significance of each term in a Substantial Derivative of a function Ø.	[3]	1	II
Q.2(a)	Write the momentum equation in x direction. Reduce this equation to incompressible flow condition.	[2]	1	III
Q.2(b)	Draw a differential element of thickness dx, dy, dz in conservative form of flow model and show all surface force terms required for momentum equation at inlet and outlet along *x, y, z directions*.	[3]	1	III
Q.3(a)	A 2D steady velocity potential equation is given as: $(1-M^2)\,Ø_{xx} + Ø_{yy} = 0$ Show how shall be its behavior based on value of M.	[2]	2	III
Q.3(b)	For a differential element of thickness dx, dy, dz in conservative form of flow model, show various expressions of rate of work done due to body and surface forces at inlet and outlet along *x directions*.	[3]	1	III
Q.4	The governing non-dimensional equations of fluid motion for steady, invicid and incompressible flow in two dimensions are given by: $\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0$ $u\frac{\partial u}{\partial x}v\frac{\partial u}{\partial y}+\frac{\partial p}{\partial x}=0$ $u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+\frac{\partial p}{\partial y}=0$ Classify the system of equations.	[5]	2	IV
Q.5(a)	Explain the characteristic features of Elliptic and Hyperbolic equations.	[2]	2	IV
Q.5(b)	Explain various types of boundary conditions for a CFD solution.	[3]	2	IV

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