

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M. Tech.
BRANCH: SER

SEMESTER : II
SESSION : SP/2024

SUBJECT: SR578 COMPUTATIONAL FLUID DYNAMICS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
-

		CO	BL
Q.1(a)	Define computational fluid dynamics. Explain the steps involved to complete a CFD project. [5]	1	2
Q.1(b)	Classify the system of equations, $(x+y)\partial u/\partial x + \partial v/\partial y = 0$ $(x-y)\partial v/\partial x + \partial u/\partial y = 0$ [5]	1	3
Q.2(a)	Using Taylor series expansion, derive the 1 st order forward and backward differences, and 2 nd order central difference approximations of $\partial f/\partial x$. [5]	2	3
Q.2(b)	What do you understand by the numerical dissipation and dispersion? Explain with suitable examples. [5]	2	2
Q.3(a)	Discuss the Jacobi iteration method to solve the 2-D Laplace's equation $\partial^2 u/\partial x^2 + \partial^2 u/\partial y^2 = 0$ numerically. [5]	3	2
Q.3(b)	Explain the explicit and implicit methods to solve the linear convection equation $\partial u/\partial t + c \partial u/\partial x = 0$, where $c = \text{constant}$. [5]	3	2
Q.4(a)	What do you understand by checkerboard velocity or pressure distribution? How do you remove this problem for solving incompressible Navier-Stokes equations? [5]	4	2
Q.4(b)	Explain the procedure to solve incompressible Navier-Stokes equations using staggered grid. [5]	4	2
Q.5(a)	Write down the 1-D Euler equations in conservative form and find out the flux Jacobian matrix. [5]	5	3
Q.5(b)	Explain the supersonic inlet and supersonic outlet boundary conditions at the farfield boundary faces. [5]	5	2

:::25/04/2024 E:::