

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV(New) • EXAMINATION – WINTER 2016****Subject Code:2140107****Date:21/11/2016****Subject Name: Computational fluid dynamics I****Time:02:30 PM to 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS	Attribute
Q.1	Short Questions	14	
	1 Write full name of CFD?		(R/U)
	2 What is the need of CFD?		(R/U)
	3 Why wind tunnels are used?		(R/U)
	4 Name fluid flow models.		(R/U)
	5 What is boundary?		(R/U)
	6 What is an explicit approach?		(R/U)
	7 Define a control volume.		(R/U)
	8 Define grid.		(R/U)
	9 Why grid generation is important?		(R/U)
	10 What is a Prandtl Mayer Expansion Wave?		(R/U)
	11 What is the difference between Expansion wave and Compression wave?		(R/U)
	12 What is forward difference?		(R/U)
	13 Define error and stability.		(R/U)
	14 Define unstructured grid.		(R/U)
Q.2	(a) What is partial derivative and substantial derivative?	03	(R/U/A)
	(b) Derive continuity equation for any of the model.	04	(U/A)
	(c) Derive momentum equation for viscous flows.	07	(U/A)
	OR		
	(c) Derive momentum equation for inviscid flows.	07	(U/A)
Q.3	(a) What is conservation and non conservation forms of governing equations?	03	(R/U/A)
	(b) Convert non conservation form of continuity equation in a conservation form	04	(U/A)
	(c) Derive energy equation in non conservation form.	07	(U/A)
	OR		
Q.3	(a) What is a generic form of CFD? Why it is required?	03	(R/U/A)
	(b) Derive the expression for substantial derivative.	04	(U/A)
	(c) Explain fluid flow models in detail.	07	(U/A)
Q.4	(a) Write Euler's model in generic form.	03	(R/U/A)
	(b) Write Navier stokes model in generic form.	04	(U/A)
	(c) Apply Maccormark technique to solve density for new time step for 1-D continuity equation.	07	(U/A)
	OR		
Q.4	(a) Brief the isentropic flow relations used to solve Prandtl Mayer Expansion Waves.	03	(R/U/A)
	(b) Explain the characteristics of Prandtl Mayer Expansion waves.	04	(U/A)
	(c) Explain in detail basic steps for Maccormark Technique.	07	(U/A)

Q.5	(a)	Enlist the basic steps involved in CFD solutions.	03	(R/U/A)
	(b)	Write a short note on Lax-Wendroff technique	04	(U/A)
	(c)	Derive 2 nd order derivative terms of Laplace equation in difference terms.	07	(U/A)

OR

Q.5	(a)	Explain in brief, an implicit approach.	03	(R/U/A)
	(b)	Explain the difference between FDM, FEM	04	(U/A)
	(c)	Write a short note on structured grid and unstructured grid.	07	(U/A)
