Subject Code…… **ROLL NO……**

SEMESTER EXAMINATION 2022-23
1st year M.Tech. Thermal Engineering

CFD and Heat Transfer (TET-302)

Duration : 3 hrs **Max. Marks: 100**

Note:- Attempt all questions. All question carry equal marks. In case any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q.1.	**Answer any four parts of the following.**	**5×4=20**
	a) Discuss the factors which contribute to errors in finite difference formulation. b) Explain the different boundary conditions used in CFD. c) Explain the different models of flow with derivation of continuity equation. d) Find the finite difference equation for Laplace equation using central difference approximation. e) Explain the different models of flow with derivation of continuity equation. f) How the continuity and momentum equations are coupled in case of compressible flows?	
Q.2.	**Answer any four parts of the following.**	**5×4=20**
	a) List down the advantages of CFD over experimental methods. b) How do you classify boundary conditions? c) What are the advantages and disadvantages of κ -ε model? d) What are the applications of CFD? e) Describe the physical mechanism of convection. How is the convection heat-transfer coefficient related to this mechanism. f) Differentiate lax Wendroff time stepping with Runge- kutta time stepping .	
Q.3.	**Attempt any two parts of the following.**	**10×2=20**
	a) Derive an expression for 1-D unsteady state heat conduction equation by using Explicit and implicit approach. b) What is computational fluid dynamics? What are the reasons for its rapid growth in recent times? Explain with an example how computational fluid dynamics is useful as a powerful research tool. c) Derive an expression for unsteady state 2-D heat conduction equation in Cartesian coordinates by using Explicit approach. State the stability criteria.	

Q.4.	**Attempt any two parts of the following.**	**10×2=20**
	a) Derive the stability criteria for unsteady one dimensional heat transfer phenomena and list the assumptions. b) Find out the temperatures of the given 2-D problem with no heat generation and by taking cell size as 1 in all directions. Assume K=1. by using finite volume method. Temperatures at Left and Top Boundaries as 00C and Remaining As 1^0C. c) Derive the first order accurate forward difference and backward finite difference approximation for the second derivative of with respect 'X' using Taylor's series expansion.	
Q.5.	**Attempt any two parts of the following.**	**10×2=20**
	a) A simplified one -dimensional inviscid, incompressible, laminar flow is defined by the following momentum equation in the x direction : $$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}=-\frac{1}{\rho}\frac{\partial p}{\partial x}$$ Name each term and discuss their contribution to the flow. b) Which of the following is most accurate and why? Forward difference, backward difference, and central difference . c) Describe the node-centred and vertex-centred finite volume schemes with suitable sketches.	