Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End term Examination, June/July 2020

Course: Computational Fluid dynamics **Semester: VIII**
Program: (ADE) **Time : 03 hrs.**
Course Code: GNEG403 **Max. Marks: 100**

Instructions:

SECTION A (15*2=30 marks)
(Answer of each question)

S. No.		Marks	CO
Q1	Which of these is not a type of flows based on their mathematical behaviour? a) Circular b) Elliptic c) Parabolic d) Hyperbolic	**2**	**CO1**
Q2	The lines along which the derivatives of the dependent variables are indeterminate are called _____ a) parabolic lines b) characteristic lines c) hyperbolic lines d) transition lines	**2**	**CO1**
Q3	The stability of the Crank-Nicolson scheme for finite volume approach is constrained by ____ a) CFL number b) Peclet number c) Time-step size d) Spatial grid size	**2**	**CO1**
Q4	Find the nature of the second-order wave equation. a) Hyperbolic/elliptic b) Parabolic c) Hyperbolic d) Elliptic	**2**	**CO1**

Q5	How many numerical diffusion terms does the second-order upwind Euler scheme have? a) Infinity b) No diffusion term c) One term d) Two terms	**2**	**CO1**
Q6	Which of these methods of solving a system of equations will be needed after using an explicit scheme? a) Sequential b) Simultaneous c) Iterative d) Direct	**2**	**CO1**
Q7	An equation modelled using infinitesimally small element leads to _____ a) Partial differential equation b) Integral equation c) Differential equation d) Linear differential equation	**2**	**CO1**
Q8	What is the main disadvantage of explicit schemes in a time-dependent problem? a) Marching solution b) Simultaneous equations c) Small time-step size d) Small grid size	**2**	**CO1**
Q9	For flows over a flat plate, at length scales near to the length of the flat plate, which of these is correct? a) Inertial force is zero b) Inertial force is large c) Inertial force is equal to viscous force d) Viscous force is large	**2**	**CO1**
Q10	Which of these statements is correct? a) Inertia forces dominate in the flow far from the wall b) Viscous forces dominate in the flow far from the wall c) Inertia forces are small in the flow far from the wall d) Viscous forces are large in the flow near the wall	**2**	**CO1**

Q11	3. Which of these laws define the dimensionless quantities u+ and y+? a) Velocity-defect law b) Log-law c) Newton's law of viscosity d) Law of the wall	**2**	**CO1**
Q12	A rectangular plane stress element has ……degree's of freedom a) 3 b) 5 c) 8 d) 6	**2**	**CO1**
Q13	In weighted residual technique, the methods adopted are (a) Galerkin's method b)least square method c)none of the above d) all of the above	**2**	**CO1**
Q14	The triangular node element is used in a) One dimensional problem b) Two dimensional element c) Three dimensional element d) None of the above	**2**	**CO1**
Q15	In Galerkin's weighted residual method the shape function or interpolation function may be --- a) Same b) Different c) May be same or different d) Depends on the type of equation solved	**2**	**CO1**
	SECTION B (10*5=50 marks) **(Answer of each question should be below 150 words)**		
Q 16	Comment on the CFD tools utilization and its limitation.	**5**	**CO1**
Q 17	Differentiate between dispersive and dissipative error in context of numerical discretization.	**5**	**CO2**
Q 18	Explain the boundary conditions used in FVM.	**5**	**CO3**
Q 19	Differentiate between the FVM and FEM.	**5**	**CO1**
Q 20	Give and explain the five errors in CFD and give examples	**5**	**CO1**

Q 21	Discuss about the wave equation used in Finite difference method	**5**	**CO2**
Q 22	Differentiate between explicit and implicit methodology using one dimensional wave equation	**5**	**CO2**
Q 23	Define the terms consistency and convergence for numerical simulation.	**5**	**CO1**
Q 24	Emphasis on the advantages and limitation of Finite Difference, Finite Element and Finite Volume Method.	**5**	**CO2**
Q 25	Discuss the stability criteria and how it is achieved in numerical solution	**5**	**CO3**
SECTION C (1*20 = 20 marks)			
Q 26	Explain the steps to solve an equation (given in differential form) using Finite volume method. OR Explain the steps to solve an equation (given in differential form) using Finite element method.	**20**	**CO4**