Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: Computational Fluid Dynamics (GNEG 401) **Semester: VIII**
Program: Mechanical & MSNT
Time: 03 hrs. **Max. Marks: 100**

Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Define the LAX method for solving one dimensional wave equation with the CFL condition	**5**	**CO3**
Q 2	Differentiate between SIMPLE and SIMPLEC methodology using in finite volume method	**5**	**CO5**
Q 3	Define the terms consistency, convergence, stability for numerical simulation.	**5**	**CO1**
Q4	Enlist the four different types of FEM elements with their usual applications	**5**	**CO4**

SECTION B

Q 5	Develop an algorithm to solve 2-D unsteady heat conduction equation given below using BTCS scheme. $\frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2}=\alpha\frac{\partial T}{\partial t}$	**10**	**CO6**
Q 6	Compute the stability analysis for one dimensional heat conduction equation for implicit scheme. OR Discuss the stability criteria for one dimensional first order wave equation. To have the stability discuss any two methodology used in brief	**10**	**CO2**
Q7	Explain the convective boundary condition and its implication in FDM and FVM method	**10**	**CO3& CO4**
Q8	Discuss the Burger equation and discretize it for stable solution for invicid flow condition.	**10**	**CO3**

SECTION-C

Q 9	Discretize and deduce the FVM equations for orthogonal structured grid for solve first order equation $\frac{\partial E}{\partial t}+\frac{\partial F}{\partial x}+\frac{\partial G}{\partial y}=0$ for the cell volume P with unit thickness in direction perpendicular the paper	**20**	**CO5**

	plane. The boundary conditions are constant temperature, constant heat flux, convection and radiation on east, west, south and north faces respectively. Or Discretize and deduce the FVM equations for curved structural mesh to solve steady state heat conduction equation with heat generation for a cell volume P with unit thickness in direction perpendicular to the paper plane. The boundary conditions are constant temperature, constant heat flux, convection and radiation.		
Q 10	Derive interpolation functions using FEM method for 2D heat conduction equation given below. From derived interpolation function deduce the local stiffness matrix. $K\nabla^2 T + Q = 0$, Where notations have their usual meanings. (Note: Use three node element for interpolation function)	**20**	**CO4**