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

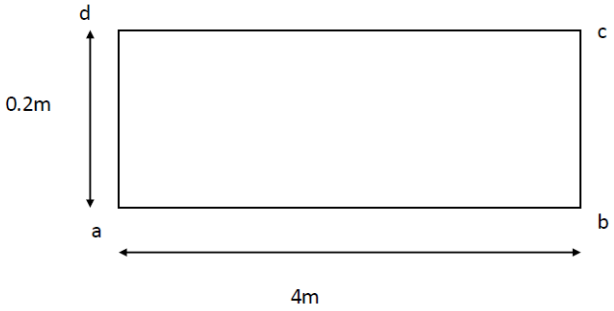
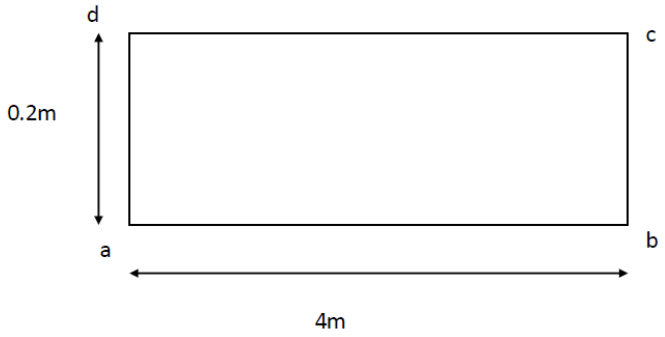
Course: Computational Fluid Dynamics (GNEG403) **Semester: VIII**
Program: B.Tech- Mechatronics, ADE
Time: 03 hrs. **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q 1	How computational fluid dynamics is different from analytical and experimental methods? Write its advantages and limitations.	**4**	**CO1**
Q 2	Explain the following a) Truncation error b) Round off error	**4**	**CO2**
Q 3	Distinguish between : a) Steady flow and un-steady flow b) Compressible and incompressible flow	**4**	**CO3**
Q 4	Discretize the following equation using forward and central difference schemes. $\left[\frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2}+\frac{\partial^2 T}{\partial z^2}\right]=0$	**4**	**CO5**
Q 5	Explain the stability of numerical scheme with a suitable example.	**4**	**CO5**

SECTION B

Q 6	Differentiate between finite difference methods, finite volume method and finite element method.	**10**	**CO1**
Q 7	Discretize the continuity equation for 3D unsteady compressible flow using BTCS and FTCS scheme.	**10**	**CO2**
Q 8	Find out the shape functions for 6 node 2D element.	**10**	**CO3**
Q 9	Formulate the 2D steady heat conduction in a rectangular geometry shown in the figure by using **finite volume method**. Boundary condition on surface 'ab' is constant temperature (T=A), on surface 'bc' is constant heat flux (q=B), on surface 'cd' is constant temperature (T=C) and on surface 'da' is constant heat flux (q=D).	**10**	**CO4**

	 (OR) Formulate the 2D steady inviscid flow in a rectangular geometry shown in the figure by using **finite volume method**. Boundary condition on surface 'ab' is wall with no slip condition, on surface 'bc' is pressure outlet, on surface 'cd' is wall with no slip condition and on surface 'da' is inlet velocity. 		
	SECTION-C		
Q 10	Derive the energy equation for 3D unsteady flow in Cartesian coordinates.	**20**	**CO4**
Q 11	Formulate the 2D steady heat conduction with constant volumetric heat generation in finite element method. Find out the shape functions and stiffness matrix for a triangular element. Boundary condition is constant temperature though out the boundary. (OR) A metal rod of length 3m is kept at a temperature of 500K at its base and 300K at the tip. If the material of the rod is isotropic and homogeneous, determine the temperature of the rod at 1m from the base of the rod. Use **finite element method;** assume steady state heat conduction and no volumetric heat generation.	**20**	**CO5**