Reg.No. _____

Karunya UNIVERSITY

(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – Nov/Dec – 2016

Semester : 2016-17 ODD
Code : 14AE3002 **Duration : 3hrs**
Sub. Name : Advanced Computational Fluid Dynamics **Max. marks : 100**

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	Define substantial derivation?	1	3
	b.	Write down the conservative form of the continuity equation and explain the terms involved..	1	5
	c.	Derive the energy equation for a viscous flow in partial differential non-conservation form	1	12
		(OR)		
2.	a.	Define local derivative and convective derivative.	1	5
	b.	What are the important applications of CFD in engineering?	2	5
	c.	Derive the continuity equation in partial differential conservation form.	1	10
3.	a.	Derive $\left(\frac{\partial u}{\partial x}\right)_{i,j} = \frac{u_{i+1,j} - u_{i-1,j}}{2\Delta x} + O(\Delta x)^2$	1	5
	b.	Consider the second order PDE $\frac{d^2u}{dr^2} + \frac{1}{r}\frac{du}{dr} - \frac{u}{r^2} = 0$ and boundary values are u (3) = 0 .009, u (7.5) = 0 .004. Divide the domain into five grid points. Discretize the above equation by finite difference method and calculate the values of u at three grid points and compare the results with analytical solution.	2	15
		(OR)		
4.	a.	Consider the source free heat conduction in an insulated rod whose ends are maintained at constant temperatures of 100°C and 500°C respectively. Calculate the steady state temperature distribution in the rod. Thermal conductivity k=1000W/m.K, cross sectional area A is 0.001 m^2.	2	20
5.	a.	What is ADI (Alternating Direction Implicit) method.	1	8
	b.	Explain in detail, the solution methodologies of Direct and iterative methods.	1	12
		(OR)		
6.	a.	Differenciate between explicit approach and implicit approach for the solution of diiference equation. Formulate the explicit form for 1D heat conduction equation.	1	20
7.	a.	Explain in detail about the different turbulence models used in CFD and also explain about its significance in real time practical problems.	2	
		(OR)		

8.	a.	What is the principle of ‘large eddy simulation’ approach?	2	6
	b.	Describe the two equation turbulence model with the necessary transport equations.	2	14
		Compulsory:		
9.	a.	How the initial and boundary conditions are applied to the nozzle flow?	2	10
	b.	Derive the continuity, momentum and energy equation for the supersonic flow over the flate .	1	10

ALL THE BEST