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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)**M.Tech I Year II Semester (R16) Regular Examinations MAY/JUNE 2017****COMPUTATIONAL FLUID DYNAMICS**

(Thermal Engineering)

(For Students admitted in 2016 only)

Time: 3 hours

Max. Marks:60

(Answer all Five Units 5 X 12 =60 Marks)

UNIT-I

- 1 a. Explain the difference between FDM and FVM with suitable example 6M
 b. Explain the explicit and implicit approach with the help of one dimensional heat conduction equation. 6M

OR

- 2 a. Explain the different boundary conditions used in CFD. 4M
 b. Find the finite difference equation for Laplace equation using central difference approximation. 8M

UNIT-II

- 3 Consider the problem of source-free heat conduction in an insulated rod whose end are maintained at constant temperatures of 100 and 500. Calculate the steady state temperature distribution in the rod with $k=1000$ W/mK, Area = $10e-3$ m² and length=0.5m 12M

OR

- 4 A thin plate is initially at a uniform temperature of 2000C. At a certain time of $t = 0$ second the temperature at the east side of the plate is suddenly reduced to 00C. The other surface is insulated. Using the implicit finite volume method (FVM) in conjunction with a suitable time step size to calculate the transient temperature distribution of the slab and compare it with the analytical solution at time $t = 50$ seconds. The data are: plate thickness $L = 2$ cm, thermal conductivity $k = 10$ W/mK and $\rho c = 10 \times 10^6$ J/m³/K. 12M

UNIT-III

- 5 Why boundary conditions are needed? List common thermal and flow boundary conditions used in CFD. 12M

OR

- 6 Derive the energy equation from the first principles 12M

UNIT-IV

7 Explain the concept of SIMPLE algorithm with pressure correction and velocity correction equations. What is the difference between SIMPLE and SIMPLER algorithms? 12M

OR

8 a. Give the difference between laminar and turbulent flows. What do you understand by vortex stretching, energy cascade, length-scale ratio, time-scale ratio and velocity-scale ratio? 6M

b. Give the difference between collocated grid and staggered grid and explain their relative merits and demerits. 6M

UNIT-V

9 Explain the significance of the wall function for solving the turbulence problems. 12M

OR

10 Explain how staggered grid arrangement helps in coupling the pressure velocity terms for solving the governing equation and bring out the concept of checker board arrangement 12M

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