Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May – 2017**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14AE2019** | **Duration :** | **3hrs** |
| **Sub. Name :** | **COMPUTATIONAL FLUID DYNAMICS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Justify CFD is a research tool. | CO1 | 4 |
| b. | Differentiate between Eulers model and Navier stoke’s model of equations . Write the Momentum equation in x,y and z direction. | CO1 | 4 |
| c. | Derive the general form of conservation equation for a physical quantity Φ and extract the continuity equation in two dimensional unsteady, Incompressible fluid flow. | CO1 | 12 |
| (OR) | | | | |
| 2. | a. | Explain the classification of Partial differential equations. | CO1 | 10 |
| b. | Derive the energy equation for a viscous flow in partial differential non-conservation form. | CO1 | 10 |
| 3. | a. | Define fourier number? | CO1 | 2 |
|  | b. | Write the advantage of implicitapproach. | CO1 | 3 |
|  | c. | Derive the stability criterion for the explicit scheme for 1D transient conduction. | CO2 | 15 |
| (OR) | | | | |
| 4. | a. | Consider a cylindrical fin with uniform crosssectional area A.The base is at a temperature at 1200C and end is insulated.The fin is exposed to an ambient temperature of 300C. One dimensional heat transfer in this situation is governed by    Where h is the convective heat transfer coefficient, P the perimeter, k thermal conductivity of the material and T∞ ambient temperature .  Divide the domain into three grid points .Calculate the temperature distribution along the fin and compare the result with the analytical solution.  Data : n2 = hP/kA = 25/m2 and L = 1.2 m | CO2 | 20 |
| 5. | a. | A large plate of thickness L = 3 cm with constant thermal conductivity k = 0.45 W/m.K and uniform heat of generation q = 800 kW/m3. The faces A and B are at temperatures of 90 oC and 180 oC respectively. Assuming that the dimensions in the y and z directions are so large that the temperature gradients are significant in x directions only . Divide the domain into five grid points. Calculate the values of T at five grid points and solve the matix equation by using the TDMA. The governing equation is  Take A = 1m2 | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | Describe the Tri-Diagonal Matrix Algorithm for solution of set of linear algebric equations. | CO1 | 12 |
|  | b. | Apply the Jacobi method to solve the following equations.  5 x1 -2 x2  + 3 x3 = -1  - 3x1 + 9x2  + x3 = 2  2 x1 - x2  -7 x3 = 3  Continue iterations until two successive approximations are identical when rounded to three significant digits. | CO1 | 8 |
| 7. | a. | Show how the staggered grid is implemented for the pressure equation . | CO2 | 5 |
|  | b. | Present the SIMPLE algorithm and show how the pressure is determined. | CO1 | 15 |
| (OR) | | | | |
| 8. |  | Draw a flow chart and describe SIMPLE algorithm in detail for two dimensional laminar steady flow equations in Cartesian co-ordinates. | CO1 | 20 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Describe about the steps involved in modeling of combustion system. | CO2 | 8 |
|  | b. | Explain in detail about the different turbulence models used in CFD and also explain about its significance in real time practical problems. | CO2 | 12 |

ALL THE BEST