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**

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| **Code :** | **14AE3002** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ADVANCED COMPUTATIONAL FLUID DYNAMICS** | **Max. marks :** | **100** |

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

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Define substantial derivation? | CO1 | 4 |
| b. | Write down the conservative form of the continuity equation and explain the terms involved. | CO1 | 4 |
| c. | Derive the momentum equation for a viscous flow in non conservation form. | CO1 | 12 |
| (OR) | | | | |
| 2. | a. | Justify CFD is a research tool. | CO2 | 5 |
| b. | Consider the irrational, two dimensional, inviscid, steady flow of a compressible gas. If the flow is slightly perturbed from its free stream condition and the Mach number is either subsonic or supersonic then classify the following equation. | CO1 | 15 |
| 3. | a. | Write down the differential form of the generic transport equation and explain the terms involved. | CO1 | 4 |
|  | b. | Consider the second order PDE      and boundary values are u (1) = 0 .007  u (5.5) = 0 .002  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. | CO2 | 16 |
| (OR) | | | | |
| 4. |  | For the following equation    a) Obtain finite discretized form of finite difference quotient.  b) Using explicit approach write the algebraic equation for 4×4 grid (7×7) | CO1 | 20 |
| 5. |  | Explain in detail about the methodologies of Relaxation method and Alternating direction implicit method. | CO1 | 20 |
| (OR) | | | | |
| 6. |  | Differenciate between explicit approach and implicit approach for the solution of diiference equation. Formulate the implicit form for 1D heat conduction equation. | CO1 | 20 |
| 7. |  | Describe the various turbulence models and highlight the merits of each model. | CO2 | 20 |
| (OR) | | | | |
| 8. | a. | What is turbulence modeling. | CO2 | 5 |
|  | b. | Describe the two equation turbulence model with the necessary transport equations. | CO2 | 15 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Draw and explain the subsonic and supersonic flow through the CD nozzle and derive the continuity equation for the quasi one dimensional flow through the CD nozzle. | CO2 | 15 |
|  | b. | Derive the energy equation for the supersonic flow over the flate . | CO1 | 5 |