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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**Supplementary Examination – June – 2017**

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| **Code :** | **14AE2019** | **Duration :** | **3hrs** |
| **Sub. Name :** | **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 derivative. | CO1 | 3 |
| b. | Write down the general form of the conservation equation and explain the terms involved. | CO1 | 3 |
| c. | Derive the continuity equation in Integral conservation form. | CO1 | 14 |
| (OR) | | | | |
| 2. | a. | Explain the Classification of Partial Differential Equations. | CO1 | 10 |
| b. | Consider the irrotational, 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 | 10 |
| 3. |  | Consider a cylindrical fin with uniform cross sectional 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 |
| (OR) | | | | |
| 4. |  | Explain the following methods with suitable example and give their merits and demerits.  a) Explicit Method. b) Implicit Method. c) Semi Implicit Method. | CO1 | 20 |
| 5. |  | Consider the source free heat conduction in an insulated rod whose ends are maintained at constant temperatures of 80°C and 450°C respectively. One dimensional heat transfer is governed by    Divide the domain into five grid points. Calculate the steady state temperature distribution in the rod and solve the matix equation by using the TDMA.  Thermal conductivity k = 900W/m.K, cross sectional area A is 0.001 m2. | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | Describe the Tri-Diagonal Matrix Algorithm for solution of set of linear algebric equations. | CO1 | 12 |
|  | b. | Apply the Gaussian elimination method to solve the following equations.  10 x1 +x2  + x3 = 12  x1 + 10x2  + x3 = 12  x1 +x2  +10 x3 = 12 | CO1 | 8 |
| 7. | a. | Define staggered grid approach. | 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 the principle of ‘large eddy simulation’ approach. | CO2 | 4 |
|  | b. | Describe the important features of the turbulent flow. | CO1 | 4 |
|  | c. | 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