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

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**End Semester Examination – Nov/Dec – 2018**

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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. | Differentiate between Eulers model and Navier’s stokes model of equations. | CO1 | 5 |
| b. | Derive the continuity equation in Integral conservation form. | CO1 | 15 |
| (OR) | | | | |
| 2. | a. | Write the complete Navier–Stokes equations in differential conservation form. | CO1 | 5 |
| b. | Derive the energy equation for a viscous flow in partial differential non-conservation form. | CO1 | 15 |
|  |  |  |  |  |
| 3. | a. | Explain the Classification of Partial Differential Equations. | CO1 | 10 |
| b. | Derive the finite difference expression for a second order derivative with forward, backward and central difference approximations. Give order of accuracy in each case. | CO1 | 10 |
| OR | | | | |
| 4. | a. | Explain the finite volume method for any governing equation with suitable boundary conditions. | CO2 | 10 |
| b. | Derive the stability criterion for the explicit scheme for ID transient conduction problem. | CO1 | 10 |
|  |  |  |  |  |
| 5. |  | A large plate of thickness L = 3 cm has constant thermal conductivity k = 0.45 W/m.K ,uniform heat of generation q = 800 kW/m3. The faces A and B are at temperatures of 90 oC and 180 oC respectively. Assume 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 control volume. Calculate the values of T at three grid points. The governing equation is  Take A = 1m2 | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | Describe the Tri-Diagonal Matrix Algorithm for solution of set of liner algebric equations. | CO1 | 10 |
| 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 | 10 |
|  |  |  |  |  |
| 7. | a. | Define staggered grid approach? | CO1 | 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. | Explain the need for turbulence modeling in dealing with CFD problem.Name the various turbulenc models used in CFD. | CO2 | 10 |
| b. | Describe the principle of ‘large eddy simulation’ approach? | CO2 | 5 |
| c. | Describe the important features of the turbulent flow. | CO2 | 5 |