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



**End Semester Examination – Nov / Dec – 2019**

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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. | Justify – CFD compliments pure theory and pure experiment. | CO1 | 10 |
| b. | Derive the energy equation for a viscous flow in partial differential non-conservation form in cartesian system. | CO1 | 10 |
| **(OR)** | | | | |
| 2. | a. | Discuss the types of partial differential equation and highlight the features with suitable examples. | CO1 | 10 |
| b. | Derive the conservation of mass equation with a neat sketch as applicable to a regular control volume. | CO1 | 10 |
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| 3. | a. | Explain the necessity of courant number. | CO1 | 5 |
| b. | Highlight the advantages of implicitapproach. | CO1 | 5 |
| c. | Derive the stability criterion for the explicit scheme for 1D transient conduction. | CO2 | 10 |
| **(OR)** | | | | |
| 4. | a. | Discuss forward, central and backward difference schemes. | CO2 | 10 |
| b. | Formulate finite difference equation for steady two dimensional heat equation. | CO2 | 10 |
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| 5. |  | 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 180oC 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 matrix 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.  20 x1 + x2  -2 x3 = 17  3x1 + 20x2  - x3 = -18  2 x1 -3 x2  +20 x3 = 25  Continue iterations until two successive approximations are identical when rounded to three significant digits. | CO1 | 8 |
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| 7. | a. | Explain the characteristics of staggered grid in pressure equation. | CO2 | 10 |
| b. | Derive an expression for one dimensional steady state diffusion problem using finite volume method. | CO1 | 10 |
| **(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. |  | Discuss about classical turbulence models used in CFD and also the features of it. | CO2 | 20 |