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



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

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| **Code :** | **17AE2010** | **Duration :** | **3hrs** |
| **Sub. Name :** | **AERODYNAMICS** | **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. | Derive continuity equation in polar form. | CO2 | 15 |
| b. | Show that the velocity potential lines and stream lines are perpendicular to each other. | CO1 | 5 |
| **(OR)** | | | | |
| 2. | a. | Write short notes on   1. Circulation. 2. Stream function. | CO1 | 5 |
| b. | Explain the numbering system of NACA 23015 airfoil. | CO3 | 5 |
| c. | Distinguish between symmetrical airfoil and cambered airfoil. | CO3 | 10 |
|  |  |  |  |  |
| 3. |  | Explain about lifting flow over a cylinder with neat sketches. | CO3 | 20 |
| **(OR)** | | | | |
| 4. | a. | Derive Bernoulli’s equation for incompressible flow from Newton’s second law of motion. | CO2 | 10 |
| b. | Two points on a streamline in the steady flow of air upper and the lower points are 150 m/s and 50m/s respectively. Find the difference in the static pressures between two points taking density ρ= 1.225 kg/m3. | CO2 | 10 |
|  |  |  |  |  |
| 5. | a. | Explain vortex sheet and starting vortex. | CO4 | 5 |
| b. | Prove kelvin’s circulation theorem with a neat sketch. | CO4 | 15 |
| **(OR)** | | | | |
| 6. |  | Derive the expression of lift and moment coefficients of thin airfoil theory for an unsymmetrical airfoil. | CO4 | 20 |
|  |  |  |  |  |
| 7. | a. | State Kutta conditions. | CO4 | 5 |
| b. | Explain joukowski’s transformation and conformal mapping. | CO3 | 15 |
| **(OR)** | | | | |
| 8. | a. | Explain displacement thickness and momentum thickness. | CO6 | 5 |
| b. | Air at 30˚C flows over a flat plate at a velocity of 2m/s. The plate is 2m long and 1.5 m wide. Calculate the following:   1. Hydrodynamic boundary thickness. 2. Average friction coefficient. 3. Drag force. | CO6 | 5  5  5 |
|  | | **Compulsory**: |  |  |
| 9. | a. | State Biot – Savart’s law. | CO5 | 5 |
| b. | Using Biot – Savarts law compute the down wash velocity at a point on the central line of symmetry at a distance h a from the bound vortex in a horse shoe vortex. | CO5 | 15 |