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



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

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| **Code :** | **14AE2006** | **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. | Explain with neat sketch the force and moment acting on a airfoil. | CO2 | 04 |
| b. | Derive the integral form of momentum equation with neat sketch. | 16 |
| **(OR)** | | | | |
| 2. | a. | Derive the equation for continuity for compressible & incompressible flow. | CO2 | 10 |
| b. | The velocity components in a two-dimensional velocity field for an incompressible fluid are expressed as;  u = y3/3+2x-x2y, v = xy2-2y-x3/3  Show that these functions represent a possible case of an irrotational flow. | 10 |
|  |  |  |  |  |
| 3. | a. | Write the short note on following:  i) Angular velocity.  ii) Strain rate.  iii) Vorticity and dilatation of a fluid element. | CO1 | 6+6+8 |
| **(OR)** | | | | |
| 4. | a. | Derive the Navier – stoke’sequation with sketch. What is calorically perfect gas? | CO2 | 16 |
| b. | Illustrate the characteristics of a vortex flow with neat sketch. | 04 |
|  |  |  |  |  |
| 5. | a. | Show that equipotential lines and stream lines are mutually perpendiculars. | CO1 | 04 |
| b. | Derive the expressions for stream function and velocity potential function. | 04 |
| c. | Derive the stream function of following:  i) Doublet Flow ii) Vortex Flow. | 6+6 |
| **(OR)** | | | | |
| 6. | a. | If ϕ is defined as a scalar function of space coordinates and time, then show that curl grad ϕ=0 certifies the flow field to be irrotational. | CO1 | 10 |
| b. | How will you obtain the stagnation points for a flow over a Rankine full body in combination of uniform flow with source and sink? Also derive the equation of stagnation streamline for ranking oval. | 10 |
|  |  |  |  |  |
| 7. | a. | Illustrate the concept of vortex sheet and its singnificances. | CO1 | 08 |
| b. | Prove that flow over a spinning cylinder create lift & doesn’t drag. (Neglect the viscous effect). | 12 |
| **(OR)** | | | | |
| 8. | a. | Derive the classical thin airfoil theory equation for symmetrical airfoil. | CO2 | 12 |
| b. | Explain the following with neat sketch:   1. Kelvin’s circulation theorem. 2. Helmholtz’s Theorem. | 4+4 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Starting from the definition of bound vortex and horse shoe vortex derive the fundamental equation of prandtl’s lifting line theory and state how do you obtain lift and induced drag coefficients. | CO2 | 20 |