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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**End Semester Examination – April/May – 2017**

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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. | The NACA stands for……………………… | CO1 | 1 |
| b. | State the significance of CL. | CO1 | 2 |
| c. | Define the Reynolds Number, Mach Number. | CO1 | 2 |
| d. | Derive the three dimensional momentum equation for cartesian coordinate system and expand it to viscous terms. | CO1 | 15 |
| (OR) | | | | |
| 2. | a. | Calculate the Reynolds number and Mach number of 50 cm cylinder kept at the test section of low speed wind tunnel. Assume test section velocity is 25m/s. | CO1 | 4 |
| b. | Derive the lift and drag equation for flow over an airfoil and explain how the airplanes are flying? | CO1 | 16 |
| 3. | a. | Define Potential flow. | CO1 | 2 |
|  | b. | The two dimensional continuity equation satisfies the velocity potential. Prove it. | CO1 | 2 |
|  | c. | Explain and derive the stream function, potential function of Source flow and vortex flow. | CO1 | 16 |
| (OR) | | | | |
| 4. | a. | Consider the velocity field given by and v = Calculate the equation of the streamline passing through point (0,5). | CO1 | 6 |
|  | b. | Explain and derive the stream function, potential function for Rankine half body. | CO2 | 14 |
| 5. | a. | State the Kutta condition . | CO1 | 10 |
|  | b. | Define circulation and explain why circulation required for aerofoil to create lift? | CO1 | 10 |
| (OR) | | | | |
| 6. | a. | Explain in detail about the stream and potential function of lifting flow over a circular cylinder. | CO1 | 15 |
|  | b. | Explain the concept behind the Magnus effect. | CO1 | 5 |
| 7. | a. | Starting with the definition of circulation, derive Kelvin’s Circulation Theorem. | CO1 | 6 |
|  | b. | State and prove that the lift produced by the symmetrical airfoil is  CL= 2πα by using the thin-aerofoil theory approximation. | CO2 | 14 |
| (OR) | | | | |
| 8. | a. | What is the nomenclature of NACA 23012 airfoil? | CO2 | 4 |
|  | b. | Consider an airfoil NACA 23012. The mean camberline for this airfoil is given by  for  and for  Calculate (a) Angle of attack at zero lift, (b) the lift coefficient when α=5˚, (c) the moment coefficient about quarter chord, and (d) the location of the center of pressure in terms of xcp/c, when α=5˚. | CO2 | 16 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Enumerate the following concept, 1. Starting vortex 2. Horse-shoe Vortex | CO1 | 6 |
|  | b. | Derive the Prandtl’s lifting line theory and prove that drag coefficient is directly proportional to square of lift coefficient and inversely proportional to 3.14 times aspect ratio of the elliptic wing. | CO1 | 14 |