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 – Nov/Dec– 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. | In an incompressible flow field with free-stream velocity 50m/s, the value of pressure coefficient Cp at a point P is -3. What is the velocity at point P? | CO1 | 5 |
| b. | Derive energy equation in Cartesian coordinates (x, y, z). | CO1 | 15 |
| (OR) | | | | |
| 2. | a. | For incompressible flow field given by following velocity components, find the missing velocity component. ,  , =? | CO1 | 10 |
| b. | For incompressible flow field given by following velocity components, find the missing velocity component. , , = ? | CO1 | 10 |
| 3. | a. | Find the stream function for 2D incompressible flow field in Cartesian coordinates system given by and . | CO1 | 10 |
|  | b. | For a flow field given by , find the flow rate per unit width in z-direction between points (1,1,0) and (-1,-1,0). | CO1 | 10 |
| (OR) | | | | |
| 4. | a. | For a velocity field with velocity potential given by , find the stream function Ψ. | CO1 | 10 |
|  | b. | For a velocity field with stream function given by , find the potential function . | CO1 | 10 |
| 5. |  | A sink of strength is located 3m upstream of source of strength . The combination is placed in uniform velocity field along the line joing sink to source. It is noted that at a point 2.5m equi-distant from source and sink, the velocity is normal to line joining source and sink. Find   1. The velocity of uniform flow field. 2. The velocity at the point mentioned above. | CO2 | 10  10 |
| (OR) | | | | |
| 6. |  | Consider a pair of source and sink of equal strength Λ in a uniform stream with velocity U. The uniform velocity is aligned with x-axis. The SINK is at (0,-c) and SOURCE is at (0,c) while uniform flow is along x-axis towards +.   1. What is velocity potential for the combination? 2. What is stream function for the combination? 3. What is the velocity at a point (x,y)? 4. What are the stagnation points of the combination? | CO2 | 5  5  5  5 |
| 7. | a. | Find the induced velocity due to Circular vortex of radius R with strength Γ at the centre of the circle. | CO2 | 10 |
|  | b. | Find the induced velocity at the centre of the rectangular vortex of strength  Γ. The sides of rectangle are is 2a and 2b. | CO2 | 10 |
| (OR) | | | | |
| 8. |  | The camberline of an airfoil is given by . Here x and y are in terms of chord c and the origin is at leading edge.  Using thin aerofoil theory, find out   1. Lift coefficient at α=0 2. Pitching moment about leading edge at α=0 3. Angle of attack α for zero lift | CO2 | 10  5  5 |
|  | | **Compulsory**: |  |  |
| 9. | a. | For a tapered with taper ratio and semi-span b, find the   1. mean chord 2. mean aerodynamic chord | CO2 | 4  6 |
|  | b. | For a wing of elliptic planform with root chord Cr and span b,findthe   1. mean chord 2. mean aerodynamic chord. | CO2 | 5  5 |

ALL THE BEST