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**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14AE2034** | **Duration :** | **3hrs** |
| **Sub. Name :** | **INTRODUCTION TO HYPERSONIC FLOWS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Define Entropy layer. How does it influence the flow field? | CO 1 | 10 |
| b. | Explain Viscous-Inviscid Interaction. Explain its implication on the flow field. | CO 1 | 10 |
| (OR) | | | | |
| 2. | a. | Define Mach number Independence principle. | CO 2 | 8 |
| b. | Show that non-dimensional flow variables after the shock are independent of Mach number under the hypesonic lmit. Give the non-dimensional form of the variables | CO 2 | 12 |
|  |  |  |  |  |
| 3 |  | Estimate the pressure distribution on the *surface of sphere* of radius R using Newtonian approximation. Estimate the drag coefficient of sphere taking reference area as projected area facing the flow.. | CO 2 | 20 |
| (OR) | | | | |
| 4 |  | Estimate the pressure distribution on the *surface of cylinder* of radius R in cross flow using Newtonian approximation. Estimate the drag coefficient of cylinder taking reference area as projected area facing the flow. | CO 2 | 20 |
|  |  |  |  |  |
| 5. |  | Define Viscous Shock layer. How is it different from shock layer? | CO 1 | 20 |
| (OR) | | | | |
| 6. |  | What are the assumptions and non-dimensional variables used in deriving equations for Hypersonic Slender body theory? | CO 2 | 20 |
|  |  |  |  |  |
| 7. |  | Consider the hypersonic boundary layer over a flat plate without pressure gradient. Using similarity consideration, derive the equation governing the similar velocity profile.  Give the boundary conditions for governing equations. | CO 2 | 20 |
| (OR) | | | | |
| 8. |  | Consider the hypersonic boundary layer over a flat plate without pressure gradient. Using similarity consideration, derive the equation governing the similar temperature profile.  Give the boundary conditions for governing equations. | CO 2 | 20 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. |  | Starting from shock relations for oblique shock, derive the relation between shock wave angle β and flow deflection angle θ for hypersonic flow ( large Mach number). | CO 2 | 20 |

ALL THE BEST