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 :** | **14AE2021** | **Duration :** | **3hrs** |
| **Sub. Name :** | **GAS DYNAMICS** | **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. | Describe the effect of Mach numbers in a supersonic flow with neat sketch. | CO1 | 5 |
| b. | Define Speed of sound. Derive an equations for velocity of sound. | CO1 | 15 |
| (OR) | | | | |
| 2. |  | Derive Energy equation based on control volume approach and explain the control volume significance. | CO1 | 20 |
| 3. | a. | A re-entry vehicle (RV) is at an altitude of 15,000 m and has a velocity of 2000 m/s. A bow shock wave envelops the RV. Neglecting dissociation, determine the static and stagnation pressure and temperature just behind the shock wave on the RV center line where the shock wave may be treated as normal shock. Assume that the air behaves as a perfect gas, with γ=1.3 and R= 288J/kg-K. | CO3 | 12 |
|  | b. | If the entropy change caused by a normal shock in an airstream is 200 J/kg-K, determine the Mach number ahead of the shock and the shock strength. | CO2 | 8 |
| (OR) | | | | |
| 4. | a. | Write short notes on Reflection and intersection of shocks. | CO2 | 8 |
|  | b. | Derive θ-β-M relation for an oblique shock with neat sketch. State its inference also. | CO2 | 12 |
| 5. |  | Derive Rankine Hugoniot equations across the normal shock with neat sketch and extends this to moving shock phenomena also. | CO2 | 20 |
| (OR) | | | | |
| 6. |  | A Mach 1.8 Laval nozzle connected to a settling chamber, maintained at 400 kPa, discharges air into a very large tank provided with pressure control device (vacuum pump) to maintain the tank pressure at any desired level. (*i*) If a shock of 5 percent strength is formed at the nozzle exit, determine the static pressure behind the shock and tank pressure. (*ii*) What should be the limiting minimum pressure in the tank to make oblique shock strong? Find the Mach number behind this strong shock. | CO2 | 20 |
| 7. |  | Derive the Prandtl-Meyer function with neat sketch. Assume stationary expansion fan. | CO2 | 20 |
| (OR) | | | | |
| 8. |  | Determine the flow field around a symmetric double wedge of 20° included angle kept at 15° angle of attack to a supersonic stream of Mach 2.4 and stagnation temperature 300K,shown in fig., by the shock-expansion theory. | CO2 | 20 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Derive Area- Mach number relation for C-D nozzle with neat sketch. | CO3 | 8 |
|  | b. | Write short notes on flow characteristics and performance of C-D nozzle based of back pressure effects. | CO3 | 12 |

ALL THE BEST