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 :** | **14AE2021** | **Duration :** | **3hrs** |
| **Sub. Name :** | **GAS DYNAMICS** | **Max. marks :** | **100** |

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

**Use of Gas Table is Permitted**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | A fighter aircraft attains its maximum velocity of 2100kmph at an altitude of 12km. The take-off speed at sea level is 300kmph. If flight speed increases linearly with altitude, calculate the stagnation temperature faced by aircraft at altitude of 0, 3, 6, 9, 12km. Assume ambient temperature to vary as , where h is altitude in km. | CO1 | 12 |
|  | b. | Air flows through a duct. At station 1, the pressure is 1.0bar and temperature is 30oC. At station 2, the pressure is 0.6bar. Calculate temperature and density at station 2. Assume flow to be isentropic. | CO1 | 8 |
| (OR) | | | | |
| 2. | a. | Derive continuity equation for unsteady compressible flow in cylindrical polar coordinate system in differential form. | CO1 | 15 |
| b. | Calculate the speed of sound for Atomic hydrogen H at temperature of 300 K. | CO1 | 5 |
|  |  |  |  |  |
| 3. |  | For an oblique shock, derive relation between Mach number M, shock angle β and flow deflection angle θ. | CO2 | 20 |
| (OR) | | | | |
| 4. |  | A wedge consist of two wedges, first with an angle of 10o and second one with another 10o compression (total 20o). This model is kept in supersonic stream of Mach 4 with temperature of 250K. Find the temperature and Mach number on both wedges. | CO2 | 20 |
|  |  |  |  |  |
| 5. | a. | Derive Area-Mach number relation for convergent-divergent duct. Consider flow to be isentropic. | CO2 | 12 |
|  | b. | A convergent-divergent nozzle is fed from a reservoir. The duct has exit area which is 4 times the throat area. Find the pressure ratio (reservoir pressure/exit pressure), if flow at exit is subsonic. | CO2 | 8 |
| (OR) | | | | |
| 6. |  | With the help of neat diagram, explain the variation in pressure in a convergent-divergent nozzle. With reference to this, explain, over-expanded and under-expanded nozzle. | CO2 | 20 |
|  |  |  |  |  |
| 7. |  | Atmospheric air at pressure 1.0135\*105 Pa and temperature 300K is drawn through a frictionless bell mouth entrance into a tube with length 3m and diameter of 0.05m. The average friction coefficient f=0.005 for the tube. The tube is perfectly insulated. Find the mass flow rate and ambient pressure at the exit to give Mach number 0.8. | CO2 | 20 |
| (OR) | | | | |
| 8. |  | A gaseous mixture of air and fuel enters a combustion chamber of constant area of cross-section. With velocity of 50 m/s at temperature 300K and pressure 0.5516\*105 Pa. The heat of reaction is 1395.5 kJ/kg. Assuming that mixture has same properties as air before and after combustion and no friction in the combustion chamber, find i. stagnation temperature, ii.Mach number, iii. static temperature at the exit of combustion chamber. | CO2 | 20 |
|  | |  |  |  |
|  | | **Compulsory:** |  |  |
| 9. |  | A two-dimensional wing as shown below is placed in a stream of Mach number 2 at an angle of attack of 2o. Using linearised theory, find CL and CD.  Wedge_Mod.jpg | CO2 | 20 |

ALL THE BEST