**Karunya University**

**(Karunya Institute of Technology and Sciences)**

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

**Supplementary Examinations – June 2016**

**Subject Title: GAS DYNAMICS Time : 3 hours**

**Subject Code: 14AE2021 Maximum Marks: 100**

**Answer ALL questions (20 x 1 = 20 MARKS)**

(Use of Gas tables is permitted)

1. **Compulsory:**

a. Consider the low-speed flow of air over an airplane wing at a standard sea level conditions; the free-stream velocity far ahead of the wing is 45 m/s. The flow accelerates over the wing, reaching a maximum velocity of 67m/s at the same point on the wing. What is the percentage pressure change between this point and the free stream? (15)

b. Calculate the isothermal compressibility for air at a pressure of 5×104 N/m2 . (5)

2. a. Distinguish between Mach wave and Shock wave. (5)

b. Consider a point in a supersonic flow where the static pressure is 4.1×104 N/m2.When a pitot tube is inserted in the flow at this point, the pressure measured by the pitot tube is 3×105 N/m2. Calculate the Mach number at this point and also entropy change across the shock. (15)

**(OR)**

3. Derive Prandtl relation for normal shock and also show the variation of mach number, pressure and temperature behind the shock.

4. Derive the expression for changes across an oblique shock in terms of flow deflection angle, mach number and wave angle.

**(OR)**

5. a. Illustrate that expansion waves are emanated from a sharp convex corner. (5)

b. Obtain the expression for prandtl-meyer function. (15)

6. Derive the expression for the area variation in terms of Mach number.

**(OR)**

7. Air enters a CD nozzle at 1.0 MPa and 800 K with a negligible velocity. The flow is steady, one dimensional and isentropic with an exit nozzle exit Mach number of 2 and throat area of 20 cm2, determine a) the throat conditions, b) the exit plane conditions, including the exit area and c) the mass flow rate through the nozzle.

8. Consider the flow of air through a pipe of inside diameter 0.15 m and length of 30 m. The inlet flow conditions are M1=0.3 and p1=1.013×105 N/m and T1=273 K. Assuming f=constant=0.005, calculate the flow conditions at the exit, M2, p2,T2 and p02.

**(OR)**

9. a. Discuss the merits of Supercritical airfoil. (10)

b. Discuss the characteristics of swept wings. (10)