APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY **D**

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015

(Mechanical Engineering)

(Common to Thermal Science &Thermal Engineering)

(01ME6205: Incompressible and Compressible Flow)

Max. Marks: 60 **Duration: 3 hours**

MEMORIAL CSI INSTITUTE OF TECHNOLOGY TRIVANDRUM-11 JOHN COX KANNAMMOOLA

Answer any **two full** questions from each Part.

Part A

1. a) Define stress tensor and explain its significance. (4 Marks)

b) Derive Reynold's transport theorem and derive the differential form of Energy equation. (5 Marks)

2. a) What is a stress field (4 Marks)

b) Derive the complex flow potentials of (i) Point source (ii) Point vortex and (iii) a Doublet flow. (5 Marks)

3. a) Derive the exact solutions of Coutte flow. (5 Marks)

b) Show that for potential flow past a two-dimensional cylinder, the variation of pressure coefficient is given by $C_P=1-4\sin^2\theta$. (4 Marks)

Part B

4. a) Explain Magnus effect (4 Marks)

b) Obtain the expression for the velocity profile for axial flow through annular space between two co-axial cylinders. (5 Marks)

5. a) Explain about Vortex Shedding. (4 Marks)

b) Obtain the Blasius solution for flow past a flat plate. Also find expressions for wall shear stress, local skin friction coefficient and total drag force. (5 Marks)

6. a) Obtain the expression for the velocity profile for doublet flow (4 Marks)

b) Derive Von Karman momentum integral equation (5 Marks)

Part C

7. a) Explain Prandtl mixing length. (5 Marks)

b) If air flows in a 20 mm diameter constant area duct at velocity of 125 m/s with a static temperature of 300 K and a static pressure of 300kPa, find the rate of heat input required to choke the flow.

(7 Marks)

8. a) Bring out the effects of heat addition and heat extraction on the flow velocity in a constant area duct Rayleigh flow when the flow is initially supersonic. (6 Marks)

b) Explain Boussineq's hypothesis. (6 Marks)

9. a) Air enters a constant area duct at 0.3 MPa and 15°C and is heated while flowing. The initial Mach number is 0.2. The final total temperature is 897°C. What are the final total pressure and Mach number? (7 Marks)

b) Explain the significance of influence coefficients in the analysis of compressible flow. (5 Marks)
