

MANIPAL INSTITUTE OF TECHNOLOGY

IV SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: AERODYNAMICS [AAE 2201]

REVISED CREDIT SYSTEM (12/06/2017)

Time: 3 Hours

MAX. MARKS: 50

(05)

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.

1A. Explain the followings

- a) Profile drag
- b) Effective angle of attack

ent Institution of Manipal University

- c) Center of Pressure
- d) Vortex sheet
- e) Irrotational flow
- 1B. Explain the nonlifting flow over a circular cylinder in terms of stream function. (05)Find out where on the cylinder we achieve peak velocity.
- 2A. Consider an airplane model mounted in a subsonic wind tunnel in which the nozzle has 12-to-1 contraction ratio. The maximum C_L of this airplane model 1.54 and the wing planform area of this model is 0.72m². The maximum lift force measured through a balance is 4800N. Then calculate the maximum pressure difference allowable between wind tunnel settling chamber and the test section. If the velocity inside the test section is 50m/s and the test section is vented to the atmosphere, then for the same contraction ratio of the nozzle calculate the reservoir pressure.(consider standard atmospheric conditions for both cases)
- **2B.** Derive the energy equation (conservation law) in the differential equation **(05)** form
- **3A.** Explain the general procedure and conditions to obtain source strength over **(05)** an airfoil through the numerical source panel method.
- **3B.** What are leading edge stalls, trailing edge stalls and thin airfoil stalls. How **(05)** these stall properties influencing the shape of an airfoil. Also explain what are high lifting devices and their functions as well.

- **4A.** Explain Biot-Savart law for semi-infinite straight vortex filament and **(05)** Helmholtzs Theorems
- **4B.** With the help of fundamental equation of thin airfoil theory derive and prove **(05)** that for symmetric airfoil, center of pressure is at quarter chord point of the airfoil and the lift is directly proportional to angle of attack.
- **5A.** Explain the types of flows dealing in aerodynamics and classify the **(05)** aerodynamics according to altitude and Mach number.
- **5B.** Draw the schematic diagrams of open and closed circuit wind tunnels and **(05)** explain their features. Also write down their advantageous and disadvantageous between above mentioned wind tunnels.