2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
II B.TECH IISEMESTER REGULAR EXAMINATIONS
AERODYNAMICS-I
(AERONAUTICAL ENGINEERING)

APRIL/MAY 2006

TIME:3 HOUR
MARK:80

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS

1. Explain the geometry of a cambered airfoil. What is the role of leading edge radius? Can you separate out the effects of thickness and its effects on airfoil performance? Make use of sketches and c1-cd-a plots to illustrate your answer.

2. Make use of dimensional analysis to work out formulas for aerodynamic forces and moments.

3. An airplane weighing 4,50,000 N, with wing loading of 2750 N/ m2 has its drag polar given by $CD = 0.0216 + 0.04 C2$
L . Plot the thrust vs. velocity curve and obtain lift coefficient for minimum drag. What is the significance of this condition?

4. Given Complex Potential function $w = Uz + pz$. Analyze the force field if the flow is irrotational.

5. Consider the transformation given by ? = 1 / z. Show that the flow pattern due to uniform flow parallel to x axis gets transformed to circles of radii 1 / 2k at (0, -1 / 2k), where k depends upon U, the uniform stream velocity parallel to x axis.

6. An airscrew is required to produce thrust of 5500 Newtons at a speed of 130 m/s at sea level. The diameter of the disc is 2.8 m. Estimate the minimum power to be supplied on the basis of ideal actuator disc. Another propeller is placed in its slipstream such that its disc area is just equal to that of the slipstream. Work out the size ant input power to the second propeller on the basis of Froude momentum theory.

7. The thrust and torque grading at 1.22 m radius on each blade of a 2 bladed airscrew are 2120 N/m and 778 Nm/m respectively. Find the speed of rotation in radians / second of the airstreams immediately behind the disc at 1.22 m radius.

8. How does a twin rotor helicopter differ from a conventional helicopter? Explain its design features and operational details. Make use of sketches / plots to elaborate your answer. n