Roll No…….. **Total No. of Printed Pages: [01]**

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B. Tech(Aerospace Engg.) (Semester – 3rd)

AERODYNAMICS

Subject Code: BASES1302

Paper ID: [19113003]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

SECTION A **(2 marks each)**

Q1. Explain the followings:

a. Explain briefly why induced drag of a finite wing is more than that of an infinite wing.

b. State and explain Kutta condition.

c. Which kind of drag is predominant in the flow over bunt body and that over a stream lines body?

d. Usually, for an elliptical lift distribution over a wing must the chord vary elliptically long the span? Justify your answer with proper reasoning

e. Explain starting vortex and horse shoe vortex.

f. What is boundary layer separation?

g. Describe briefly when the use of an irrotational flow modal for incompressible aerodynamics applications is justified.

h. Distinguish between ideal and real fluids.

i. What is Conformal Transformation?

j. What are the limitations of lifting line theory?

Section-B **(5 marks each)**

Q2. In a thin aerofoil the flap chord is 30% and flap deflection angle is. Calculate the values of C1, Cm and Cmo.

Q3. What is a rankine oval? What combination of flows is required to obtain the Oval? (b) The X and Y velocity components of an fluid flow are given by U=2xy+4y+6x and v=3y+2x2+6xy. Is the flow irrotational? Is it is a physically possible flow?

Q4. Show that the combination of doublet flow and the uniform flow is equivalent to a non-lifting flow over a cylinder. Obtain the expression for velocity potential function and stream function for the combination.

Q5. Differentiate between ideal and perfect liquid.

Q6. Define and explain the circulation? Why the concept of circulation is very important in theoretical aerodynamics?

Section-C **(10 marks each)**

Q7. Consider the flow over a small flat which is 8 cm long in the flow direction and 1 m wide. The free stream conditions correspond to standard sea level, and the flow velocity is 120 m/s. Assuming laminar flow, calculate the boundary layer thickness at the downstream edge and the drag force on the plate. For the same flow over the same plate, assume that the boundary layer is now completely turbulent. Calculate the boundary layer is now completely turbulent Calculate the boundary layer thickness at the trailing edge and the drag force on the plate

Q8. It is a well known result from the thin airfoils theory that, the coefficient of lift (C1) for a symmetrical airfoils kept in the potential flow at angle α is C1=2$\pi\alpha$.Derive this result by transforming the lift flow over a circular into flow over a symmetrical airfoil using the Kutta – Joukowski transformation

Q9. (a) Explain the terms ‘Bound vortex’, ‘Starting vortex’ and ‘Horse shoe vortex’ (b) Show that for an elliptical wing loading the induced drag is minimum.