Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. winter 2019 - 20 Examination

Semester: 5 **Date: 28/11/2019**
Subject Code: 03101303 **Time: 10:30am to 01:00pm**
Subject Name: Aerodynamics- II **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Short Type Questions (each of one mark) **(15)**

1) Which statement is true for isentropic flow?
(a) T_0 = Constant (b) P_0 = constant
(c) h_0 =Constant (d) All of the above

2) For elliptical lift distribution the downwash along the chord is
a) Constant
b) Varies elliptically
c) Varies parabolically
d) None of the above

3) If the lift coefficient of the aircraft is halved then the induced drag coefficient will be
a) Twice
b) Remains same
c) One Fourth times
d) None of the above

4) If the Aspect ratio of the wing decreases then Induced drag
a) Decreases
b) Increases
c) Remains same
d) None of the above

5) the thickness of laminar boundary layer at a distance "X'' from the leading edge over a flat plate varies
a) X
b) $X^{1/2}$
c) $X^{1/5}$
d) $X^{4/5}$

6) Define inviscid flow and isentropic flow

7) Rotational and irrotational flow

8) uniform and non-uniform flow

9) According to Biot- Savart law the velocity induced at any point P in the vicinity of a infinite vortex filament is VP =

10) According to Biot- Savart law the velocity induced at any point P in the vicinity of a finite vortex filament is VP=

11) Explain Critical mach number

12) Explain Drag divergence mach number

13) Explain Skin friction drag

14) Explain Pressure drag

15) According to Blasius solution the Thickness of laminar boundary layer is given by δ=

Q.2 Answer the following questions. (Attempt any three) **(15)**

1) Using linearized theory, calculate lift and drag coefficient for a flat plate at a 5 degree angle of attack in a mach number 3 flow.

2) Explain the results of thin airfoil theory for a symmetrical and a positively cambered airfoil.

3) The value of zero lift angle of attack ($\alpha_{L=}0$) and lift curve slope of an airfoil is -2.2° and 0.11 degree respectively the wing's AR=8 Calculate the lift coefficient of the wing of an angle of attack 8. Also Calculate Induced drag coefficient?

4) Three birds are flying side by side each other having span "b" and the strength of the horse shoe vortex is Γ each. What is the net induced velocity at the mid of the middle bird?

Q.3 A) An aircraft is flying in a steady straight and level flight at Mach 2 at an altitude of 10 km ,suddenly pitched the airplane to an angle of attack of 10 degree, calculate the instantaneous lift exerted on the airplane & comment on the possible consequence. If the weight of the aircraft is 7262 kg and wing span is 19.5 m^2 **(07)**

Q.3B) Explain Ground Effect with the help of neat and clean diagram? **(08)**

OR

Q.3 B) Explain the principle of lift generation over the wing, how the wing tip vortices generated on the wings and derive the relation for induced angle of attack. Draw the relevant neat and clean diagram **(08)**

Q.4 A) Explain Big-Boy formation or V-formation with the help of neat and clean diagram **(07)**

OR

Q.4 A) Consider a finite wing with AR= 12 and tapered ratio of 0.0.6; the airfoil section is thin and symmetrical. Calculate the lift coefficient (C_L) and Induced drag coefficient at an angle of 5°. Consider δ= 0.109 **(07)**

Q.4 B) Consider a thin supersonic airfoil with chord length c = 5ft (1.524m) in a Mach 3 free stream at a standard altitude of 20,000 ft(6096m). The airfoil is at an angle of attack of 5°. **(08)**
{a) Calculate the lift and wave drag coefficients and the lift and wave drag per unit span.
{b) Compare these results with the same airfoil at the same conditions, except at Mach 2.
Comment on the results