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BAS-009

B. TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

December, 2013

BAS-009 : INTRODUCTION TO AERONAUTICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks. Use of scientific calculator is **permitted**.*

1. Define the following terms : **10**

(a) Angle of Attack
(b) Attitude of the Aircraft
(c) Stall
(d) Absolute ceiling
(e) Corner velocity

2. (a) Define pitch, roll and yaw of an aircraft. Show with a proper sketch in Cartesian co-ordinate system **5**

(b) List down the various parts of an aircraft and describe them in brief. **5**

3. (a) "Induced drag is a function of lift". Elaborate on the above statement. Show the efffect of induced drag on an airfoil. **5**

(b) What is wake drag ? Explain with a suitable sketch. **5**

4. (a) What are flaps ? Describe any two types of flaps. **5**

(b) Show that the relationship between velocity at minimum drag and velocity at minimum power is $V_{Pmin} = \left(\frac{1}{3}\right)^{\frac{1}{4}} V_{Dmin}$. **5**

5. Explain the following in brief : 10
   (a) TAS
   (b) Static Margin
   (c) Mach No.
   (d) Advance Ratio
   (e) Aspect Ratio

6. (a) Consider a straight wing of aspect ratio 6 with a NACA 2412 airfoil. Assuming low speed flow, calculate the lift co-efficient at an angle of attack of 6°. For this wing, the span effectiveness factor $e_1 = 0.95$, $C_{L_{\alpha_O}} = 0.105/\text{deg}$, $C_{L_O} = -2.2°$ 5

   (b) What is the lift co-efficient for the same wing at the same angle of attack as in 6(a) above, but for a free stream Mach no. of 0.77 ? 5

7. Derive the expression for maximum climb angle for a jet propelled airplane. Also find the rate of climb corresponding to maximum climb angle. 10

8. (a) What is energy height ? Give the expression for the same and discuss its significance. 5

   (b) Consider an airplane with an instantaneous acceleration of 2.4 m/s^2 at an instantaneous velocity of 240 m/s. At the existing flight conditions, S.E.P. is 90 m/s. Calculate instantaneous maximum rate of climb that can be obtained at these accelerated flight conditions. 5

9. Describe the various types of engine used in an aircraft. Explain Turbojet and Ramjet engine, in detail. 10