B.TECH. (AEROSPACE ENGINEERING) PROGRAMME (BTAE)

Term-End Examination

December, 2010

BAS-009 : INTRODUCTION TO AERONAUTICS

Time : 3 hours   *Maximum Marks : 70*

Note :   *Q1 is **compulsory**. Attempt any **six** from question no. 2 to question no. **10**. Use of calculator is permitted.*

1. Establish reasons for correctness of following statements in not more than five sentences and one sketch/plot in addition.

    (a) A swept wing causes increase in critical Mach number.   **2**

    (b) Leading edge strokes improve aerodynamics of swept back wings.   **2**

    (c) Aerodynamic centre is used in Aerodynamics analysis.   **2**

    (d) Leading edge slots on the wing are opened at the time of take off and landing of an airplane.   **2**

    (e) The turbulent boundary layer produces greater amount of drag for given thickness of Boundary layer.   **2**

2. (a) The pressure and temperature at sea level are standard, calculate the pressure and density at 8000 m if the lapse rate is : **6**

   (i) 0.0065 k/m

   (ii) 0.0095 k/m

   (iii) 0.0130 k/m

   (b) Define the following terms. **4**

   (i) Density.

   (ii) Relative density.

   (iii) Temperature lapse rate.

   (iv) True air speed.

3. (a) Give examples of commercial/military aircraft applicable to various stages in the history of aircraft development. **5**

   (b) What prompted use of Bi-plane, Sesquiplane configuration and why are they obsolete now? Describe function of wire and struts. **5**

4. (a) Plot the variation of Mach number M with drag coefficient C_D, hence define drag divergence Mach number. **5**

   (b) Explain the importance of indicated air speed in airplane performance. **5**

5. (a) Derive expression for induced drag. **5**

   (b) Explain various constituents of drag and methods to reduce it. **5**

6. What are high lift devices? Explain any five. **10**

7. List the pressure/force measuring devices and explain their functioning. What are flow visualising techniques and their purpose? **10**

8. (a) Derive the Brequet equation for jet engine aircraft. **5**

   (b) An airplane has a wing loading of 2000 N/m^2. Its drag polar is given by C_D= 0.018 to 0.056 $C_L{}^2$. Determine the velocity for which their airplane has maximum lift to drag ratio. **5**

9. Write short notes on the following : **10**

   (a) Loading edge high lift devices.

   (b) Unconventional aircraft.

10. Elaborate with neat sketches/plots that the effective velocity at the propeller blade is more than that of free stream, hence show that $M_{Tip}= M_{a/c}\sqrt{1+(\pi/J)^2}$, where J is advance ratio and M_{Tip} is the Mach number of propeller tip speed. **10**

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