01352

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

Term-End Examination

June, 2011

BAS-009 : INTRODUCTION TO AERONAUTICS

Time : 3 hours *Maximum Marks : 70*

Note : *Question number **1** is **compulsory**. Attempt **any six** questions from Question no. **2** to Question no. **10**. Use of calculator is permitted.*

1. Fill in the blanks :

(a) Troposphere extends from earth surface to _____ km. altitude. **1**

(b) Minimum drag occurs when parasite drag = _____. **1**

(c) Circulation in a flow means that the flow system could be resolved into a _____ . portion and _____ portion. **1**

(d) Kutta transformation is used to study _____ while Zhukovsky extended this to produce section with _____ and _____. **1**

(e) The induced velocity in the downwards direction called as _____. **1**

(f) _____ speed condition in which an aircraft flies close to the ground. **1**

(g) Flight at minimum power condition is not possible because speed does not go below the _____. 1

(h) Compressibility of fluid is the reciprocal of _____. 1

(i) Load factor is ratio of L/W of _____ speed, corresponding to _____. 1

(j) The point on the air foil at which moment is independent of the angle attack is called _____. 1

2. (a) If the sea level pressure and temperature are 100500 N/m^2 and 20°C respectively, while at some unknown attitude the pressure is 71800 N/m^2 and the temperature is −10°C. Is the atmosphere between these attitude stable or unstable. Estimate the height at which the second pair of readings were taken. Assume a linear variation of temperature with height. 5

(b) What is atmosphere ? Derive an expression how pressure depends upon temperature in troposphere. 5

3. (a) Describe trailing vortex system. 5

(b) How does down wash influence on the tailplane ? 5

4. (a) Describe air foil nomenclature. 5

(b) Define the following terms : 5

(i) Tapered wing.

(ii) Profile drag.

(iii) Thrust specific fuel consumption.

(iv) Combat range.

(v) Cruise propeller.

5. Explain with appropriate sketches, why twist is incorporated in propeller. 10

6. (a) Explain, why flaps are lowered during take off and landing of aircraft. 5

(b) Describe the function of spoilers. 5

7. (a) Describe the usefulness of a slot and flap combination on a lifting wing with appropriate $C_L - \alpha$ curve. 5

(b) An airplane weighs 160,000 N has a wing area of 42 m^2. The aircraft drag equation is $C_D = 0.014 + .05\,C_L^2$; Calculate maximum R/C at sea level and flight speed and angle of climb, if the engine thrust is 27000 N at all speeds at sea level. 5

8. (a) An airplane has a wing loading of 2000 N/m^2. Its drag polar equation is given by $C_D = 0.018 + 0.056 C_L^2$. Determine the velocity for which this airplane has $(L/D)_{max}$. 5

(b) Write short notes on the following : 5

(i) Semi - monocoque

(ii) Twisted wing

9. An airplane weighing 13250 N is powered by delivering 230 h.p. at all altitudes. If specific fuel consumption is 0.2 kg/h.p. - hr. then parameters are wing span = $b = 11m$; $S = 16.2$ m^2, $C_{DO} = 0.025$, $e = 0.8$, propeller efficiency $n_p = 0.85$. If this airplane is required to fly non - stop over distance of 1850 kms determine the fuel load to be carried for this case. 10

10. (a) What are the factors affecting 'Thrust' ? 5

(b) What are the forces acting on an airplane in flight ? 5