

BATE

Term-End Examination

June, 2012

00715

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. (a) Explain, why flaps are lowered during take off and landing of aircraft. **5+5**
(b) Describe the functions of spoilers.

2. (a) List the structural component of aircraft and explain the functions associated with them. **5+5**
(b) Discuss the earlier types of flying machines with the help of neat diagram.

3. (a) Describe the NACA nomenclature, **5+5**
(b) Distinguish between symmetrical airfoil and cambered airfoil.

4. (a) What is the need to define ISA and give its values at standard sea level condition ? 5+5=10
(b) Distinguish between Troposphere and Stratosphere.

5. On a certain day the barometric pressure is found to be 750 mm of mercury. A U-tube, filled with alcohol of relative density 0.82, has one limb connected to a point on a model wing in a wind-tunnel and the other limb is open to the atmosphere. The liquid level in the first limb is 25 mm higher than that in the second limb. 10

Calculate :

- (a) The pressure difference between the point on the model and the atmospheric and
(b) The absolute pressure at that point. The relative density of mercury is 13.6 and the density of water is $10,00 \text{ kg/m}^3$.
6. Calculate the pressure and density at 10,000 m in the ISA. The pressure at sea level is 101.325 Nm^{-2} , the sea level temperature is 288 K and the lapse rate is 0.0065 Km^{-1} . Given $R = 287.26 \text{ J kg}^{-1} \text{ K}^{-1}$. 10
7. Experiments were conducted in a wind tunnel with a wind speed of 50 km/hr on a flat plate of size 2 m long and 1 m wide. The density of air is 1.15 kg/m^3 . The co-efficients of lift and drag are 0.75 and 0.15 respectively. 10

Determine :

- (a) The lift force
- (b) The drag force
- (c) The resultant force
- (d) Direction of resultant force
- (e) Power exerted by air on the plate.

8. The air-speed indicator fitted to a particular aeroplane has no instrument errors and is calibrated assuming incompressible flow in standard conditions. While flying at sea level in the ISA the indicated air speed is 950 km/hr. What is the true air speed ? Take $\gamma = 1.4$; $R = 287.3 \text{ J kg}^{-1} \text{ K}^{-1}$. In standard condition $P = 101.315 \text{ kN/m}^2$; $\rho_{\text{air}} = 1.226 \text{ kg/m}^3$. **10**
9. In streamline air flow near the upper surface of an aeroplane wing the velocity just outside the boundary layer changes from 257 kmh^{-1} at a point A near the leading edge to 466 kmh^{-1} at a point B to the rear of A. If the temperature at A is 281 K, calculate the temperature at B. **10**
Take $\gamma = 1.4$. Find also the value of the local Mach number at the point B.
10. Write short notes on *any two* of the following **2x5=10**
- (a) Classification of Air-craft
 - (b) Hovercraft
 - (c) Use of Propeller
 - (d) V-n diagram.