INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
M.Tech I Semester End Examinations (Regular) - February, 2017
Regulation: IARE–R16
INTRODUCTION TO AEROSPACE ENGINEERING
(Power Electronics and Electrical Drives)

Time: 3 Hours   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) What are the effects that the spacecraft may experience in the space? Briefly explain those effects? **[10M]**

   (b) What are hot air balloons? How they changed the face of the aeronautical history? **[4M]**

2. (a) What are the different steps involved in wind tunnel testing? Explain each step briefly? **[10M]**

   (b) What are the parameters that affect aerodynamic forces? **[4M]**

UNIT – II

3. (a) Explain Bernoulli's principle on airflow and pressure distribution flow over wing section with a neat sketch? **[10M]**

   (b) Explain the significance of speed of sound in air? **[4M]**

4. Consider the isentropic air flow over the airfoil sketched in the following figure 1. The free stream pressure, velocity and density are 1.013 bar, 804.7 kmph and $1.23 kg/m^3$ respectively. At a given point "A" on the airfoil the pressure is 0.7167 bar. What are the Mach number and the velocity at point "A"? **[14M]**
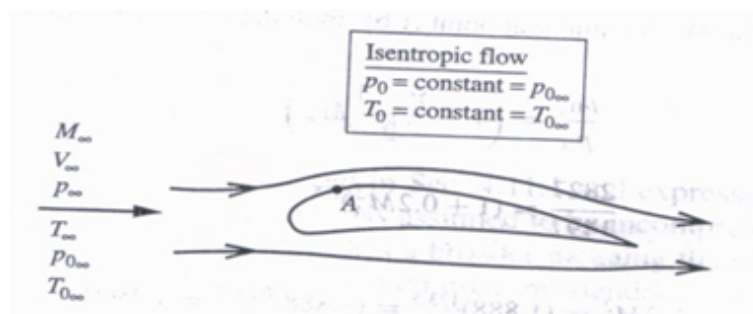

Figure 1

UNIT – III

5. (a) Briefly describe about various types of drag acting on aircraft? **[8M]**

   (b) What is meant by compressibility drag and explain the prediction of drag divergence Mach number? **[6M]**

6. Consider a thin supersonic airfoil with chord length c = 1.524m in a Mach 3 free stream at a standard altitude of 6096m. The airfoil is at an angle of attack of 5^0. **[14M]**

   (At 6096m, $\rho_\infty = 0.654\,kg/m^3$, T=248.6K)

   i. Calculate the lift and wave drag coefficients and the lift and wave drag per unit span

   ii. Compare these results with the same airfoils at the same conditions, except at Mach 2.

UNIT – IV

7. (a) Explain the criteria for longitudinal static stability of an aircraft? **[10M]**

   (b) Determine the performance parameters of aircraft in accelerated aircraft? **[4M]**

8. Explain the mechanism of a typical Ramjet engine with a neat sketch and draw the pressure – specific volume diagram for an ideal ramjet. **[14M]**

UNIT – V

9. (a) Explain about fatigue life analysis implemented to aircraft structural design? **[8M]**

   (b) Explain about various size effects in conventional aircraft design? **[6M]**

10. (a) Explain the working of various types of rocket propellants? **[8M]**

    (b) Differentiate between a single stage rocket and a multi stage rocket? **[6M]**