

## INTERNATIONAL CENTRE FOR APPLIED SCIENCES MAHE, MANIPAL B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – May 2021

 $\label{eq:semistic} \textbf{I} \textbf{ SEMESTER} - \textbf{introduction to a erospace engineering and a vionics} - \textbf{iav 121}$ 

(Branch: Aeronautical/Aviation)

 Time: 3 Hours
 Date: 22 May 2021
 Max. Marks: 50

- ✓ Answer ALL questions.
- $\checkmark$  Missing data, if any, may be suitably assumed
- $\checkmark$  Standard atmosphere data table can be used
- 1A With necessary block diagram, explain about various subsystems of spacecraft. List the (5) differences between an aircraft and a spacecraft.
- **1B** What is standard atmosphere and why it is required? At 12 km in the standard atmosphere, the (5) pressure, density, and temperature are  $1.9399 \times 10^4 \text{ N/m}^2$ ,  $3.1194 \times 10^{-1} \text{ kg/m}^3$ , and 216.66 K, respectively. Using these values, calculate the standard atmospheric values of pressure, density, and temperature at an altitude of 18 km.
- 2A With neat diagram explain how a pitot static probe is used for air speed measurement. Derive an (5) expression for the Mach number in terms of temperatures at a point in free stream flow and stagnation point for a subsonic compressible flow.
- **2B** In the combustion chamber of a rocket engine, kerosene and oxygen are burned, resulting in a hot, (5) high pressure gas mixture in the combustion chamber with the following conditions and properties: Chamber temperature = 3144K, chamber pressure = 20 atm, R = 378 J/(kg)K and  $\gamma$  = 1.26. The pressure at the exit of the rocket nozzle is 1 atm, and the throat area of the nozzle is 0.1 m<sup>2</sup>. Assume Isentropic flow through the rocket nozzle. Calculate (a) the velocity at the exit (b) mass flow through the nozzle.
- **3A** What is an airfoil? With diagram, define various parameters which characterize the shape of an (5) airfoil. Draw the variation of lift coefficient w.r.t angle of attack for a symmetric airfoil. What is stalling angle of attack?
- **3B** Write about pre-operational environment of a spacecraft. What are the effects of space (5) environment on human crew involved in space missions?
- **4A** Write about integrated avionics and weapon system. What are its functional requirements? (4)
- **4B** Write about helmet mounted display and virtual cockpit? (4)
- **4C** Briefly explain the basic form of NGC loop.
- **5A** With necessary diagrams, explain the inertial navigation system used in aerospace vehicles. (5)
- **5B** Write about various phases involved in the landing process of an aircraft.

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(2)

(5)