B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E.   Semester: III
Branch: Aerospace Engineering   Duration: 3 hrs.
Course Code: 19AE3DCIAE   Max Marks: 100
Course: Introduction to Aerospace Engineering   Date: 22.09.2023

Instructions:
1. Draw figures, wherever necessary.
2. Assume suitable data wherever necessary.

UNIT - I

1. a) List down the requirements for commercial aircraft and military aircraft **8**

   b) Describe the pressure, temperature, and density altitudes in an ISA. **6**

   c) Write a brief account of the History of Indian Space Programs. **6**

UNIT - II

2. a) Briefly explain the nomenclature of a typical cambered airfoil. Draw a neat sketch and label the parts. **8**

   b) Define thrust-to-weight ratio and wing-loading for a typical aircraft. **4**

   c) Consider two different points on the surface of an airplane wing flying at 80 m/s at a standard altitude of 3 km. The pressure coefficient and flow velocity at point 1 are -1.5 and $110 \, m/s$, respectively. The pressure coefficient at point 2 is -0.8. Assuming incompressible flow, calculate the flow velocity at point 2. **8**

OR

3. a) Write a short note on the V-n diagram for a typical jet trainer aircraft. **8**

   b) Consider a turbojet engine aircraft: **8**

   W/S = 4000 N/m^2 , TSFC = 0.80 per hour, Cruise-fuel weight fraction = 0.3, AR$_w$ = 7.2, e = 0.85 & C$_{D0}$ = 0.016, V$_{cruise}$ = 800 kmph.
   Estimate the Max. Range and Endurance for cruise flight @ constant C$_L$ and

   H$_{cruise}$ = 9 km. Assume σ @ 9 km = 0.3813

   c) With a neat sketch, explain the concept of dynamic stability. **4**

UNIT - III

4. a) Briefly explain the various components of a typical Jet Engine. **8**

    b) Draw the velocity diagram for the propeller cross-section. Explain why the propeller root section has low blade setting angle than that near the tip. **7**

    c) A small ramjet engine is to be designed for a maximum thrust of 454 kg at sea level at a velocity of 290 m/s. If the exit velocity and pressure are 610 m/s and 1.0 atm, respectively, estimate the area of the inlet that should be designed. **5**

UNIT - IV

5. a) Define Partial Pressure of a Gas. Discuss how PPO_2 varies with altitude **6**

    b) What is meant by the bleed air in an aircraft? Explain its significance and sources. **6**

    c) Discuss the fuel systems used in an aircraft. **8**

OR

6. a) Discuss the principle of gyroscopic instruments. Explain any one of such instruments. **10**

    b) Estimate the true altitude of an aircraft, which is cruising at an altitude of 17,500 ft. The OAT is $-10°C$. **4**

    c) Define anti-icing and de-icing. What are the methods available to provide heated air to the thermal anti-icing system? **6**

UNIT - V

7. a) Discuss the comprehensive space programs going on in India. **8**

    b) Write a short note on challenges faced during the manufacturing of fighter aircraft. **4**

    c) Describe the Aircraft Crashworthiness. Explain the criteria used to assess crashworthiness prospectively. **8**

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