Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEC34

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2023
Regulation: UG-20
FLIGHT VEHICLE DESIGN

Time: 3 Hours **(AERONAUTICAL ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Describe the initial phase of an aircraft design and discuss the whole design philosophy of an aircraft. Explain with the help of suitable diagram. [BL: Understand| CO: 1|Marks: 7]

   (b) An aircraft has gross weight of 10000lb. At the end of the mission segment, it has weight fraction as 0.985. Determine fuel consumed for this mission. weight for warm and takeoff =0.97, climb = 0.985 and land = 0.995 [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) What are the different types of tail configurations and wing configurations available? Explain their effects with neat sketches. [BL: Understand| CO: 2|Marks: 7]

   (b) A jet transport aircraft is flying with a crew load of 175kg, payload of 1400kg and fuel weight of 500kg. Find out fuel to empty weight fraction if design take-off gross weight of the aircraft is 5600lb [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Explain about jet engine integration and also explain how length, diameter, and weight vary with the scale factor for the typical jet engine. [BL: Understand| CO: 3|Marks: 7]

   (b) A prop-driven aircraft having fuel weight of 650kg. Now, aircraft is taxing on runway, after which it has fuel fraction of 0.975. Determine fuel used during taxing of aircraft, if W0 = 5000kg [BL: Apply| CO: 3|Marks: 7]

4. (a) Visualize the importance of the V-n diagram and draw a V-n diagram for a typical jet trainer aircraft. [BL: Understand| CO: 4|Marks: 7]

   (b) An aircraft has the mission profiles as given in Table 1 with their respective mission weight fraction. There is a 10% allowance for reserved fuel. Now, due to some reason the loiter weight fraction has changed to 0.90. Now, with the same amount of fuel as the initial, will aircraft be able to perform loiter? [BL: Apply| CO: 4|Marks: 7]

Table 1

Mission	Weight fraction
Engine start-up	0.975
Taxi	0.98
Climb	0.970
Cruise	0.989
Loiter	0.96
Landing	0.975

MODULE – IV

5. (a) Describe the static stability and dynamic stability of the aircraft with suitable examples and how stability is important in the design of aircrafts? [BL: Understand| CO: 5|Marks: 7]

   (b) Determine trim angle if, trim lift coefficient is 0.75 and lift curve slope is 4.5per rad. Consider elevator deflection as 1.056 per rad and trim elevator angle of 0.020 rad. [BL: Apply| CO: 5|Marks: 7]

6. (a) Explain about departure criteria with the expressions of the aileron divergence parameter another departure parameter Cn-β dynamic which includes the effects of the mass moments of inertia. [BL: Understand| CO: 5|Marks: 7]

   (b) Illustrate the procedure to design an aircraft and the necessary parameters to be taken into consideration in terms of concepts like aerodynamics, propulsion, structures, materials, performance stability and flight mechanics. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Describe improved conceptual sizing methods and write the expression for the duration of time to perform the mission segment. [BL: Understand| CO: 6|Marks: 7]

   (b) Write about the case study on general dynamics of F-16, SR-71 Blackbird, Northrop-Grumman B-2 Stealth Bomber. [BL: Apply| CO: 4|Marks: 7]

8. (a) Write short notes on
   i) Elements of life cycle cost
   ii) Cost analysis [BL: Understand| CO: 6|Marks: 7]

   (b) Summarize about design optimization method. Discuss in detail about DC – 3 aircraft. [BL: Apply| CO: 6|Marks: 7]