

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII EXAMINATION – WINTER 2025

Subject Code:3170101

Date:24-11-2025

Subject Name:Aircraft Design

Time:10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

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|------------|--|-----------|
| Q.1 | (a) What are the main stages in the conceptual design of a flight vehicle? | 03 |
| | (b) How does aerodynamics impact the conceptual design of a flight vehicle? | 04 |
| | (c) 1.Why is weight estimation critical in flight vehicle design?
2.What methods are used for initial weight estimation in the conceptual design phase? | 07 |
| Q.2 | (a) What is the relationship between weight estimation and performance requirements? | 03 |
| | (b) 1.What is the relationship between wing loading and aircraft performance?
2. How does wing loading affect stall speed? | 04 |
| | (c) 1. What is thrust-to-weight ratio, and how is it calculated?
2.What is the relationship between thrust-to-weight ratio and fuel efficiency?
3. What is the role of wing sweep in high-speed aircraft? | 07 |
| | OR | |
| | (c) 1.What is the role of fuselage length in overall aircraft performance?
2. How does the fuselage design differ between passenger aircraft and military aircraft? | 07 |
| Q.3 | (a) What is the primary function of the fuselage in an aircraft? | 03 |
| | (b) What are the advantages of designing a tapered wing? | 04 |
| | (c) 1.How does the thrust-to-weight ratio impact the design of an aircraft for supersonic speeds?
2. How is wing loading optimized for different types of aircraft (e.g., commercial, military, or UAVs)? | 07 |
| | OR | |
| Q.3 | (a) How is wing area determined during initial sizing? | 03 |
| | (b) What are the differences in tailplane sizing between a conventional tail and a T-tail configuration? | 04 |
| | (c) How does the position of the center of gravity (CG) affect tailplane sizing? Explain in details. | 07 |
| Q.4 | (a) How does thrust-to-weight ratio impact engine selection? | 03 |
| | (b) How does engine size and weight influence the design of the aircraft's structure? | 04 |
| | (c) 1. What is the role of afterburners in military aircraft propulsion systems? | 07 |

2. What is the impact of hybrid-electric propulsion on modern aircraft design?

OR

- Q.4** (a) What is the difference between a conventional and a canard configuration? **03**
(b) What does "loft" refer to in the context of aircraft design? **04**
(c) How does lofting help in optimizing drag reduction for aircraft surfaces? **07**

- Q.5** (a) What is VTOL? **03**
(b) What is wing loading, and how is it calculated? **04**
(c) Write a note on Statistical group weight method. **07**

OR

- Q.5** (a) What are the primary functions of landing gear on an aircraft? **03**
(b) What are the different types of landing gear configurations commonly used in aircraft design? **04**
(c) Summarize the role of the fuel system in delivering fuel to the engines and managing fuel consumption. **07**
