Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

End Semester Examination, December 2023

Course: Aircraft Design — **Semester: VII**
Program: B.Tech Aerospace Engineering — **Time : 03 hrs.**
Course Code: ASEG4020 — **Max. Marks: 100**
Instructions: Design DATA allowed. Assume missing DATA if any.

SECTION A
5Qx4M=20Marks

S. No.		Marks	CO
Q 1	Illustrate different design requirements of surveillance Aircraft.	**4**	**CO1**
Q 2	Sketch design process flowchart for typical aircraft design.	**4**	**CO1**
Q 3	Compare mission profiles of surveillance and fighter aircraft.	**4**	**CO1**
Q 4	Differentiate between different aircraft Horizontal and Vertical Tail configurations.	**4**	**CO2**
Q 5	Estimate *lift curve slope* of Light Sport aircraft LSA having taper ratio 0.25 and flight Mach no. 0.4 .	**4**	**CO2**

SECTION B
4Qx10M= 40 Marks

S. No.		Marks	CO
Q 6	Compare advantages of different types of Staging of Launch Vehicles.	**10**	**CO2**
Q 7	Show that for Launch Vehicle payload mass/initial mass ratio ($\pi_{payload}$) is given by $\pi_{payload} = \pi_{burnout} - \pi_{se}$ Where (π_{se}) is empty structure mass/initial mass ratio.	**10**	**CO2**
Q 8	An aircraft has the following features: Weight for the payload=800N Estimated fuel fraction-0.35 Empty Weight fraction=$0.85W_0^{-0.7}$ Calculate and plot Payload Trade.	**10**	**CO3**
Q 9	Design the main wing that would be suitable for this airplane Cruise Mach number 0.2 Cruise Altitude 3,000 m Wing loading 100 kg/m^2 **OR** Design wing for Fighter aircraft having cruise velocity 450 m/s, wing loading 80 kg/m^2, take-off weight 1000 kg. (provide 3 views neat sketch)	**10**	**CO3**

<table>
<tr><th colspan="4">SECTION-C
1Qx40M=40 Marks</th></tr>
<tr><td>Q 10</td><td>Design a two-seater winged hybrid airship considering design requirement cruise range 450 km at cruise speed 100 km/hr and ground roll for take-off about 150 m. Before the start of the last phase of mission profile, loiter time is set equal to 30 minutes.
For the airship to be heavy enough for ground handling, the ratio of hydrostatic (from Helium gas) to hydrodynamic lift is set equal to 49:51

a) Estimate Gross take-off weight for simple mission profile.
b) Estimate Sizing (Wing, Horizontal tail, Vertical tail, Hull Gondola, Landing gears, Misc. Engine), and
c) Estimate of parasite drag by component (Wing, Horizontal tail, Vertical tail, Hull Gondola, Landing gears, Misc. Engine cooling, etc.) and overall drag polar equation.
OR
Design aircraft that will transport 80 business-class passengers and their associated baggage over a design range of 12000 km and Cruise at 10,000 m and M=0.85 , with a climb rate of at least 1.524 m/s, landing distance 1579 m, Take-off distance 1690 m.

a) Estimate Gross take-off weight for transport aircraft mission profile.
b) Estimate Sizing (Wing, Horizontal tail, Vertical tail, Hull Gondola, Landing gears, Misc. Engine), and
c) Estimate of parasite drag by component (Wing, Horizontal Tail, Vertical Tail, fuselage, Landing gears, Misc. Engine cooling, etc.) and overall drag polar equation.</td><td>40</td><td>CO4</td></tr>
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