



**B.E DEGREE EXAMINATIONS: NOV/DEC 2022**

(Regulation 2018)

Seventh Semester

**AERONAUTICAL ENGINEERING**

U18AEI7201:Aircraft Design

**COURSE OUTCOMES**

<b>CO1:</b>	Conduct trade-off between the conflicting demands of different disciplines by performing a detailed preliminary design of a complete aircraft
<b>CO2:</b>	Decide mission specific wing loading for the aircraft.
<b>CO3:</b>	Select appropriate design and dimensional parameters for wing, fuselage and Empennage.
<b>CO4:</b>	Identify the constraints in a mission and select the power plant for the aircraft.
<b>CO5:</b>	Estimate the performance parameters and size the control surfaces
<b>CO6:</b>	Estimate loads on different aircraft components.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**  
**(Answer not more than 40 words)**

1.	The empty mass fraction of an aircraft is 0.52, Fuel mass fraction is 0.35 and maximum take-off weight is 80900 kg. Calculate the pay load in kg if the crew mass is 517 kg.	CO1	[K <sub>3</sub> ]
2.	Draw the flow chart of the aircraft design process.	CO1	[K <sub>2</sub> ]
3.	What is the effect of wing loading during take-off?	CO2	[K <sub>1</sub> ]
4.	Differentiate between Cruise and Service ceilings	CO2	[K <sub>1</sub> ]
5.	State function of empennage.	CO3	[K <sub>1</sub> ]
6.	In low speed aircraft, state the primary purpose of leading edge sweep.	CO3	[K <sub>2</sub> ]
7.	List the different types of aircraft engines available for speeds between Mach 2 to 4.	CO4	[K <sub>2</sub> ]
8.	What is the purpose of a dihedral wing?	CO5	[K <sub>1</sub> ]
9.	What is the role of Stringers in Aircraft Wings?	CO6	[K <sub>1</sub> ]
10.	What are the 4 typical loads on an aircraft?	CO6	[K <sub>1</sub> ]

**Answer any FIVE Questions:-**

**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

11.	a)	Compare merits and demerits between high wing and low wing configuration.	8	CO1	[K <sub>2</sub> ]
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	b)	What are the different stages in aircraft design? Explain the various studies and calculations carried out and performed in each stage.	8	CO1	[K <sub>2</sub> ]
12.		How is the total weight of an aircraft broken up into components? What is the importance of weight fractions in aircraft design? For a long-range civilian transport aircraft, list typical values/range of values for the different weight fractions.	16	CO2	[K <sub>4</sub> ]
13.		Classify the aircraft based on wing vertical location and explain the characteristics of each one with merits and demerits.	16	CO3	[K <sub>4</sub> ]
14.		How the Thrust to Weight ratio and wing loading affects the aircraft performance? Explain the selection process of Thrust to Weight ratio and wing loading for an aircraft.	16	CO4	[K <sub>4</sub> ]
15.		<p>A propeller aircraft having the following design data</p> <p> <math>W = 56,000 \text{ N}</math>                      <math>V_{TO} = 1.2 V_{stall}</math>                      <math>\eta_p = 75\%</math>  <math>S = 1000 \text{ m}^2</math>                      <math>C_D = 0.024 + 0.04 C_L^2</math>                      <math>T_0 = 2400 \text{ BHP/engine}</math>  <math>C_{Lmax} = 2.4</math>                      <math>\mu = 0.25</math>                      No. of Engines: 02 </p> <p>Determine the minimum ground run distance required for take-off at sea-level in a standard atmosphere.</p>	16	CO5	[K <sub>5</sub> ]
16.		Explain the semi-monocoque wing and fuselage construction briefly.	16	CO6	[K <sub>2</sub> ]

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