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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

**B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022**

Regulation: R18

**FLIGHT VEHICLE DESIGN**

**Time: 3 Hours**

**(AE)**

**Max Marks: 70**

**Answer FIVE Questions choosing ONE question from each module  
(NOTE: Provision is given to answer TWO questions from any ONE module)**

**All Questions Carry Equal Marks**

**All parts of the question must be answered in one place only**

## MODULE – I

1. (a) What are the different types of wings? Explain how any one particular type of wing suits a particular mission. [7M]
- (b) Explain airfoil thickness ratio with the effects of drag on critical Mach number, on maximum lift, thickness ratio and historical trend with graphs. [7M]
2. (a) What are the different steps in the conceptual design of a commercial passenger aircraft? Discuss the reasoning behind the order of steps. [7M]
- (b) Explain tail geometry for some general-aviation aircraft with tail aspect ratio and taper ratio. [7M]

## MODULE – II

3. (a) Write a short note on wrap fuselage lofting. Describe a method for verifying the same. [7M]
- (b) List the factors involved in deciding the location of the wing with respect to the fuselage. Explain in detail. [7M]
4. (a) How the volume of the fuselage of a commercial passenger aircraft can be computed? Explain it briefly. [7M]
- (b) Describe the calculation process for drag optimized tail arm length for only horizontal tail and frustum fuselage. [7M]

## MODULE – III

5. (a) What are the different types of landing gear arrangements? Explain anyone in detail. [7M]
- (b) Discuss in brief the methodology and considerations for the selection of propulsion system for a fighter aircraft. [7M]
6. (a) Describe inlet geometry with pitot inlet layout and inlet location for buried engines. [7M]
- (b) What is coefficient of lift ( $C_L$ )? With the help of neat graph explain how  $C_{Lmax}$  varies with the different types of flaps. [7M]

## MODULE – IV

7. (a) Describe briefly about estimation of dynamic characteristics and handling qualities. [7M]  
(b) Explain about departure criteria with the expressions of the aileron-alone divergence parameter, which includes the effects of the mass moments of inertia. [7M].
8. (a) Discuss the lateral directional stability of passenger aircraft with moment equation. [7M]  
(b) Describe the handling qualities of an aircraft Cooper – Harper rating scale. [7M]

## MODULE – V

9. (a) What is D.O.C (direct operating cost) and I.O.C (indirect operating cost) and how do they affect the design process? [7M]  
(b) Explain the design considerations of Northrop Grumman B-2 stealth bomber. [7M]
10. (a) Explain carpet plot and matrix plot based upon superimposing the takeoff weight plots from sizing matrix cross plots. [7M]  
(b) Describe improved conceptual sizing methods and write the expression for the duration of time to perform the mission segment. [7M]

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