

Hall Ticket No

Question Paper Code: AAE017



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## MODEL QUESTION PAPER-I

B.Tech VII Semester End Examinations, November/December – 2019

Regulations: IARE - R16

### FLIGHT VEHICLE DESIGN

(Aeronautical Engineering)

Time: 3 hours

Max. Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

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

#### UNIT – I

1. a) What are the three different phases of aircraft design requirements? [7M]  
b) Explain clearly, the sets of data required to be available before the beginning of preliminary design phase and the data that is expected to be ready at the end of this phase [7M]
2. a) Explain how lift to drag is estimated and explain about each factor that influences L/D ratio. Write about Fuel-fraction estimation and how it is calculated approximately? [7M]  
b) Explain about power loading and horse power-to-weight with the equation. [7M]

#### UNIT – II

3. a) Explain tail geometry for tail and taper aspect ratio for vertical tail for sailplane aircraft? Explain fixed engine sizing for an military cargo / bomber aircraft [7M]  
b) What is lofting definition? Explain briefly about flat wrap lofting with the required examples? [7M]
4. a) Describe control surfaces sizing and types of control surfaces explain in detail with neat sketches. What is producibility, maintainability? [7M]  
b) Explain the major differences in the designs of the fuselage of a fighter and bomber plane. Justify your answer? With neat sketches. [7M]

#### UNIT – III

5. a) What are the types of landing gears and location of landing gears on the aircraft? Explain common options for landing-gear arrangement with the help of neat sketch? [7M]  
b) Explain the load categories with typical fighter limit load factor. And also explain aircraft loads in detail? [7M]
6. a) Explain about typical engine performance curves of max power thrust and military power thrust [7M]

- b) Explain the landing gear arrangements for multi-wheel main landing gear with neat sketch? Explain landing gear arrangements for tail dragger, quadric-cycle, and multi-bogey. [7M]

#### UNIT – IV

7. a) What is estimation of stability and control derivatives? What is steady level flight? What is steady level flight? [7M]  
b) Explain briefly about estimation of dynamic characteristics and handling qualities? [7M]
8. a) Write about the case study on General dynamics F-16, SR-71 Blackbird, Northrop-Grumman B-2 Stealth Bomber. [7M]  
b) Explain the lift-curve slopes of the wing and tail are obtained with the different methods. [7M]

#### UNIT – V

9. a) What are Direct operating cost and indirect operating cost? Determine the final base line design configuration. [7M]  
b) Describe improved conceptual sizing methods and write the expression for the duration of time to perform the mission segment . [7M]
10. a) Explain carpet plot matrix and how carpet plot," is based upon superimposing the takeoff weight plots from Sizing matrix cross plots. [7M]  
b) Describe detail sizing methods with the equations which are the basis of the highly-detailed sizing programs used by the major airframe companies. [7M]



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## COURSE OBJECTIVES:

The course should enable the students to:

S. No	Description
I	Discuss the importance of conceptual design process and studying different phases of design process involved in the design
II	Understand the levels of integrated product development and principles of the baseline design-stability & control, performance and constraint analysis
III	Analyze cost estimation, parametric analysis, optimization, and refined sizing and trade studies
IV	Observe different designing processes and how an aircraft production company works on it.

## COURSE OUTCOMES (COs):

CO 1	Describe different phases of aircraft design, weight estimation and few basics of aerodynamics
CO 2	Differentiating size estimation fuel system and understanding the installation of engine systems
CO 3	Estimation of lift curve slopes maximum lift coefficient and different material selection can be found
CO 4	Understanding the concepts of stability for different control surfaces and also understanding the methods of structural analysis
CO 5	Acquiring knowledge on cost estimation research, Development, Test, and Evaluation and product cost for designing an aircraft

## COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

AAE017.01	Understanding the different designing concepts like preliminary design conceptual design and detail design
AAE017.02	Interpret the weight estimation of propulsion system structural weight empty weight
AAE017.03	Calculating the dimensioning of engine inlet location and capture area
AAE017.04	Estimation of wing geometry and wing vertical location, wing tip shapes, tail geometry and arrangements, thrust to weight ratio-statistical estimation
AAE017.05	Apply a theories and to predict the maximum lift coefficient, and complete drag build up, installed performance of an engine
AAE017.06	Development of configuration lay out from conceptual sketch.
AAE017.07	Calculating the velocity, angle of Attack, angle of attack rate, pitch rate, elevator angle.
AAE017.08	Constructing v-n diagram, air load distribution on lifting surfaces
AAE017.09	Developing the concept of Propulsion selection fuel selection.
AAE017.10	Plotting the mission segment with different weight fractions
AAE017.11	Understanding the concepts of different landing gear system
AAE017.12	Estimation of design-stability and control
AAE017.13	Analysis of performance under constrained conditions constraint

AAE017.14	Acquire Basic knowledge to solve real time problems in Aircraft propulsion and structure with different loading conditions
AAE017.15	Apply the fundamental concepts in competitive examinations

### MAPPING OF SEMESTER END EXAMINATION TO COURSE OUTCOMES

SEE Question No		Course Learning Outcomes	Course Outcomes	Blooms Taxonomy Level	
1	a	AAE017.01	Understanding the different designing concepts like preliminary design conceptual design and detail design	CO 1	Understand
	b	AAE017.02	Interpret the weight estimation of propulsion system structural weight empty weight.	CO 1	Understand
2	a	AAE017.02	Interpret the weight estimation of propulsion system structural weight empty weight	CO 1	Remember
	b	AAE017.03	Calculating the dimensioning of engine inlet location and capture area	CO 1	Understand
3	a	AAE017.04	Estimation of wing geometry and wing vertical location, wing tip shapes, tail geometry and arrangements, thrust to weight ratio-statistical estimation	CO 2	Remember
	b	AAE017.05	Apply a theories and to predict the maximum lift coefficient, and complete drag build up, installed performance of an engine	CO 2	Remember
4	a	AAE017.06	Development of configuration lay out from conceptual sketch.	CO 2	Understand
	b	AAE017.07	Calculating the velocity, angle of Attack, angle of attack rate, pitch rate, elevator angle.	CO 2	Understand
5	a	AAE017.08	Constructing v-n diagram, air load distribution on lifting surfaces	CO 3	Remember
	b	AAE017.08	Constructing v-n diagram, air load distribution on lifting surfaces	CO 3	Understand
6	a	AAE017.09	Developing the concept of Propulsion selection fuel selection	CO 3	Understand
	b	AAE017.10	Plotting the mission segment with different weight fractions	CO 3	Remember
7	a	AAE017.11	Understanding the concepts of different landing gear system	CO 4	Understand
	b	AAE017.12	Estimation of design-stability and control	CO 4	Understand
8	a	AAE017.11	Understanding the concepts of different landing gear system	CO 4	Remember
	b	AAE017.13	Analysis of performance under constrained conditions constraint	CO 4	Understand
9	a	AAE017.14	Acquire Basic knowledge to solve real time problems in Aircraft propulsion and structure with different loading conditions	CO 5	Remember
	b	AAE017.15	Apply the fundamental concepts in competitive examinations	CO 5	Understand
10	a	AAE017.14	Acquire Basic knowledge to solve real time problems in Aircraft propulsion and structure with different loading conditions	CO 5	Remember
	b	AAE017.14	Acquire Basic knowledge to solve real time problems in Aircraft propulsion and structure with different loading conditions	CO 5	Understand

Signature of Course Coordinator

HOD, AE