FLIGHT VEHICLE DESIGN LABORATORY

VII Semester: AE								

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AAE112	**Core**	-	-	3	2	30	70	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36	Total Classes: 36

I. COURSE OVERVIEW:

The aim of Flight Vehicle design (FVD) LAB is to introduce students the overview of the design process. The course covers basic principles of conceptual design process of an aircraft and the related details of all design techniques. After completion of the course the student gains adequate knowledge to design all the different phase of an aircraft design. Weight estimation for different aircrafts

II. OBJECTIVES:

The course should enable the students to:

I	Understand the basic skills involved in weight estimation for aircraft conceptual designprocess.
II	Illustrate relevant theoretical knowledge, applicable for initial sizing and configurationlayout of aircraft.
III	Evaluate basic techniques for design of aircraft using given design requirement and mission profiles.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Choose** data collection for conceptual sketch from existing aircraft forunderstanding aerodynamic performance requirements.	Apply
CO 2	**Classify** rubber engine sizing of a given fighter aircraft for calculatingthe take -off weights in order so that the aircraft meets all set requirements	Analyze
CO 3	**Make** use of airfoil geometry and co-ordinates for obtaining therequired 3D model by using designer tools like catiaV5.	Apply
CO 4	**Simplify** the performance estimations involving design layout for calculating the variation of C L and CD at angle of attack.	Analyze
CO 5	**Estimate** take-off gross weight of simple cruise mission profile forcalculating the empty weight fraction.	Evaluate
CO 6	**Identify** the total drags on an aircraft and calculate the total weight, thrust and drag for exit pressure and Mach number for the given nozzleconfigurations	Apply

IV. SYLLABUS:

LIST OF EXPERIMENTS

Week-1	**OBJECTIVES AND REQUIREMENTS OF THE VEHICLE**

Data collection for conceptual sketch from existing aircraft includes :
a. Type, Role, Mission.
b. Payload
c. Aerodynamic & performance requirements.

Week-2	**CONCEPTUAL SKETCH AND WEIGHT ESTIMATION**

a. Conceptual sketch of candidate aircraft (3-view).
b. First estimation of gross take-off weight with trade-off studies.

Week-3	**AIRFOIL DESIGN AND CONSTRAINT ANALYSIS**
a. Airfoil and wing geometry selection	
Week-4	**CONSTRAINT ANALYSIS**
a. Determination of Thrust-to-Weight ratio and Wing Loading	
Week-5	**INITIAL SIZING-I**
a. Rubber engine & fixed engine sizing.	
Week-6	**INITIAL SIZING-II**
a. Configuration layout, crew station, passengers and payload	
Week-7	**PERFORMANCE ESTIMATIONS**
a. Performance constraint analysis	
Week-8	**LOAD ESTIMATIONS-I**
a. Landing gear loads	
Week-9	**LOAD ESTIMATIONS-II**
a. Propulsion system load.	
Week-10	**COST ESTIMATION**
a. Cost estimation and parametric analysis b. Optimization and trade studies	
Week-11	**DESIGN CASE STUDY-I**
a. Design study of DC-3 b. Design study B-747	
Week-12	**DESIGN CASE STUDY-II**
I. Dynamics of F-16 II. Dynamics of SR-71	
REFERENCES:	
1. Daniel P. Raymer "Aircraft design a conceptual approach", 5th Edition 1999.	
Course Home Page:	
SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS: **SOFTWARE:** Microsoft office excel spread sheet, MATLAB, AutoCAD Tool. **HARDWARE:** Desktop Computers with 4 GB RAM 36 nos	