DEPARTMENT OF AEROSPACE ENGINEERING, IIT MADRAS
M.Tech. Curriculum

SEMESTER I

No	Title	L	T	P	C
AS5010	Engg. Aerodyn. & Flt. Mech.	3	0	0	3
AS5020	Elements of Gas Dyn. & Propln.	3	0	0	3
AS5030	Aircraft and Aerospace Structures	3	0	0	3
AS5110	Laboratory I	0	0	3	2
DPE1	Department Elective 1	3	0	0	3
MAE1	Mathematics Elective 1	3	0	0	3
	TOTAL				**17**

SEMESTER II

No	Title	L	T	P	C
AS3010	Introduction to Space Technology	4	0	0	4
AS 5040	Flight Dynamics & Performance	3	0	0	3
AS5120	Labortaory II	0	0	3	2
AS5150*	Project Phase I	0	0	0	2*
AS5210	Aerodynamic Design (Self Study)	1	0	5	4
DPE2	Department Elective 2	3	0	0	3
DPE3	Department Elective 3	3	0	0	3
	TOTAL				**19**

SEMESTER III

No	Title	L	T	P	C
AS5150*	Project Phase II	0	0	0	8*
AS5220	Structural Design	1	0	5	4
DPE4	Department Elective 4	3	0	0	3
	TOTAL				**7**

SEMESTER IV

No	Title	L	T	P	C
AS 5150	Project Phase III	0	0	0	23
	TOTAL	0	0	0	**23**

Total : **17 + 19 + 7 + 23 = 66**

Notes :

1. For students with AE background, alternate courses may be prescribed at the discretion of the Department in lieu of AS 5010, AS 5020, AS 5030.

2. Project Grades are assigned in the fourth semester. Project guide to be chosen in 2nd semester.

3. A minimum of 3 electives to be taken from the list of AS electives or their equivalents. Any other M.Tech. level course may be taken as the fourth elective with the consent of Faculty Advisor.

M.Tech. Course Contents

AS 3010 Introduction to Aerospace Technology 3003

Space mission types, Environment, Astrodynamics: fundamentals of orbital mechanics (two body motion, circular and escape velocity, motion in elliptic hyperbolic, and parabolic orbits); Basic orbital maneuvers. Rocket propulsion fundamentals: ascent flight mechanics: launch vehicle selection. Atmosphere entry; entry flight mechanics; entry heating. Attitude determination and controls; basic concepts; review of rotational dynamics; rigid body dynamics; disturbance torques; passive attitude control; active control; attitude determination. Thermal control, Spacecraft power, Telecommunications.

AS 5010 Engineering Aerodynamics & Flight Mechanics 3003

Basic equations of Fluid Mechanics. Inviscid flows. Stream function. Velocity potential. Two-dimensional incompressible flows: Laplace's equation, its solutions. Flow over airfoils; Conformal transformation, thin airfoil theory. Introduction to finite wings; Prandtl's lifting line theory. Effect of boundary layer and separation on flow over airfoils.

Atmosphere. Estimation of basic performance of an airplane. Introduction to stability and control.

AS 5020 Elements of Gas Dynamics & Propulsion 3003

Basic equations of gas dynamics. One-dimensional isentropic flows. Mach waves, Shock waves. One-dimensional flow with shocks, heat transfer and friction. Two-dimensional shocks. Prandtl-Meyer flows. Linearized two-dimensional subsonic flows; Prandtl-Glaurt/Goethert transformation. Linerized supersonic flow; Ackeret's theory.

Classification of airbreathing and rocket propulsion systems and their operation principles. Propeller theory, performance of different types of engines. Effect of altitude and forward speed. Gas turbine engine components, construction and performance.

AS 5030 Airplane and Aerospace Structures 3003

Classification of Airplanes, Principles of flight, Flight Controls, Basic Instruments and aircraft systems, Helicopters

Analysis of wings. Shear centre. Bending and torsion of closed and open tubes. Multi-cell tubes. Columns and beam-columns. Bending and buckling of plates and sheet stringer combination. Analysis of fuselage. Experimental techniques; strain gages, photoelasticity, vibration of discrete and continuous systems.

AS 5040 Flight Dynamics and Performance 3003

Brief review of: parts of an aircraft, classification of aircraft, standard atmosphere, altitude and airspeed definitions. Forces and moments acting on a vehicle in flight. Aircraft equations of motion - translation and pitching. Drag - various types of drags, drag polar, drag estimation. Review of the variation of thrust / power and SFC with altitude and velocity. Performance of airplane in level flight, glide and climb, turn, and take-off and landing. Flight envelopes. V-n diagram. Constraint diagram. Trim and stability concepts. Longitudinal static stability. Neutral point and static margin. Longitudinal control. Longitudinal dynamic modes and stability criteria. Handling quality requirements.

AS 5110 Laboratory-I - Aerodynamics Experiments 0032

AS 5120 Laboratory II - Structures Experiments 0032

AS 5210 Aerodynamic Design 1053

Introduction to systematic Design, Preliminary weight estimation, sizing from a conceptual sketch, airfoil and geometry selection, thrust loading and wing loading selection, initial sizing, configuration layout and special consideration in configuration designs. Propulsion and fuel system integration. Internal Layout, weight and balance. Design of wing, fuselage, control surfaces and landing gear and subsystems, surface controls. Performance, stability and control. Preliminary cost analysis.

Preliminary aerodynamic design of a given set of specifications. Drawing its three views and layout an estimation of its performance and stability characteristics.

AS 5220 Structural Design 1053

Structural design requirements, V-n diagram, Determination of loads acting on major airplane components such as wing, fuselage, tails etc. Buckling of semi-monocoque structures, master-column chart, stress and margin of safety Detailed design procedure of major structural components – Splice Design

Detailed structural design of the major components of an airplane including load calculations.