Indian Institute of Space Science and Technology
Thiruvananthapuram

M.Tech. Aerodynamics and Flight Mechanics
Curriculum & Syllabus  (Effective from 2017 Admission)

Department of Aerospace Engineering
Outcomes of the M.Tech. Programme

On completion of M.Tech. Aerodynamics and Flight Mechanics programme, it is expected that a student:

- Shall be able to create low fidelity aerodynamic models (using potential flow theory and boundary layer analysis) and use it to estimate forces and moments on the flight vehicle.

- Shall be capable of formulating a flight dynamic model for the vehicle (conventional fixed wing/launch vehicle) and use it along with the aerodynamic model to analyse the performance and stability of the flight vehicle.

- Shall be capable of performing the preliminary calculations for design and tracking of satellite/spacecraft trajectories.

- Shall have an understanding of the design process of the flight vehicle and the interplay between the vehicle sub systems.

- Shall also have the opportunity to be introduced to advanced topics in the areas of Aerodynamics, Optimisation, Flight Mechanics and Control through the elective courses offered.
### SEMESTER I

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### LIST OF ELECTIVES

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<td>AE849</td>
<td>Modeling and Simulation of Aerospace Vehicles</td>
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Note: Electives from other streams may also be credited after approval

### SEMESTER–WISE CREDITS

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AE601 MATHEMATICAL METHODS IN AEROSPACE ENGINEERING 3 credits


References:

AE603 AERODYNAMICS 3 credits


References:

**AE604 ATMOSPHERIC FLIGHT MECHANICS 3 credits**

Overview of aerodynamics – propulsion – atmosphere and aircraft instrumentation – Aircraft Performance: range, endurance, gliding, climbing flight, pull-up, pulldown, take-off, landing, accelerating climb, turning flight, V-n diagrams – optimal cruise trajectories – Static Stability & Control: frames of reference (body axis, wind axis) static longitudinal, directional, lateral stability and control, stick fixed and stick free stability, hinge moments, trim-tabs, aerodynamic balancing.

**References:**

**AE605 SPACEFLIGHT MECHANICS 3 credits**

References:


AE613  COMpressible Flow  3 credits


References:


E01  ELECTIVE I  3 credits
AE606  FLIGHT DYNAMICS AND CONTROL  3 credits


References:

E02  ELECTIVE II  3 credits

E03  ELECTIVE III  3 credits

E04  ELECTIVE IV  3 credits

E05  ELECTIVE V  3 credits

AE801  AERODYNAMICS AND FLIGHT MECHANICS LAB  2 credits


SEMESTER III

**AE607 AEROSPACE VEHICLE DESIGN**  3 credits


References:


**AE851 SEMINAR**  1 credit

**AE853 PROJECT WORK — PHASE I**  14 credits

SEMESTER IV

**AE853 PROJECT WORK — PHASE II**  17 credits
ELECTIVES

AE810  LINEAR ALGEBRA AND PERTURBATION METHODS  3 credits


References:

AE821  EXPERIMENTAL AERODYNAMICS  3 credits

Concept of similarity and design of experiments – Measurement uncertainty – Design of subsonic, transonic, supersonic, hypersonic, and high enthalpy test facilities – Transducers and their response characteristics – Measurement of pressure, temperature, velocity, forces, moments, and dynamic stability derivatives – Flow visualization techniques: Optical measurement techniques, refractive index based measurements, scattering based measurements – Data acquisition and signal conditioning – Signal and image processing.

References:


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**AE822 AEROACoustics**


**References:**


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**AE823 HYPERSONIC AEROTHERMODYNAMICS**


**References:**


**AE824**  
**TURBULENCE IN FLUID FLOWS**  
3 credits


References:


**AE825**  
**COMPUTATIONAL METHODS FOR COMPRESSIBLE FLOWS**  
3 credits


References:


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**AE826 NAVIGATION GUIDANCE AND CONTROL**


**References:**


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**AE827 OPTIMAL CONTROL THEORY**

References:


AE828 SPACE MISSION DESIGN 3 credits

Launch vehicle ascent trajectory design – Reentry trajectory design – Low thrust trajectory design – Satellite constellation design – Rendezvous mission design – Ballistic lunar and interplanetary trajectory design – Basics of optimal control theory – Mission design elements for various missions – Space flight trajectory optimization – Direct and indirect optimization techniques – Restricted 3-body problem – Lagrangian points – Mission design to Lagrangian point.

References:


AE829 HIGH TEMPERATURE GAS DYNAMICS 3 credits


References:


References:


Boundary Layer Theory


References:

INTRODUCTION TO FLOW INSTABILITY 3 credits


References:

APPLIED AERODYNAMICS 3 credits


References:

MODERN AIRCRAFT CONTROL DESIGN 3 credits

missile dynamics, inertial navigation system – Solution of homogeneous state equations – Concept of fundamental matrix and state transition matrix – Methods for evaluating state transition matrix – Solution of nonhomogeneous equations – Phase variable and Jordan canonical forms – Controllability and observability of the systems, pole placement design with full state feedback – Introduction to optimal control.

References:


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**AE849 MODELING AND SIMULATION OF AEROSPACE VEHICLES**

3 credits


References: