ILM

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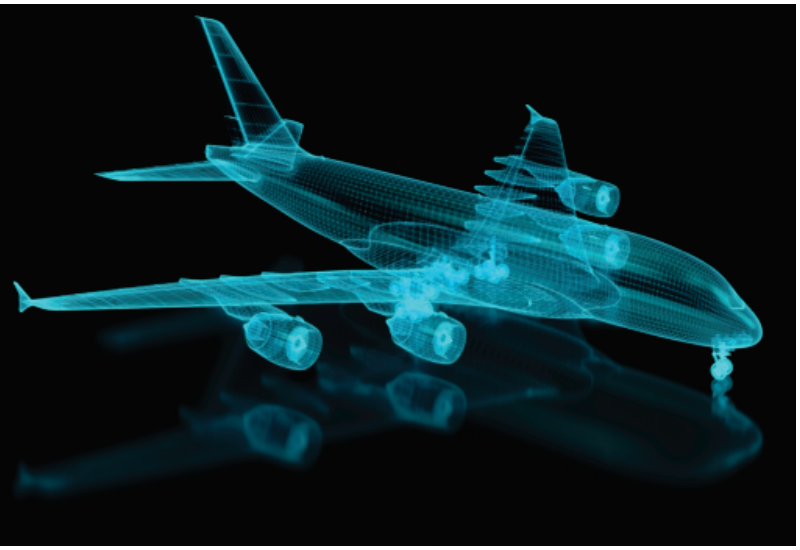
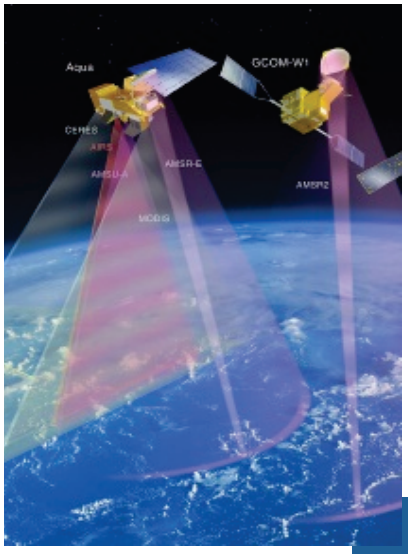
CURRICULUM





DSA01 :: Aircraft Classification

- Early aircraft designs
- Classification of aircrafts based on various factors of their operations, design, propulsion, usage & wing type

Exercise: Design Analysis of Different Aircrafts.

DSA02 :: Airport and Airspace

- Runways, Taxiways, Airport Signs and Lighting systems
- Landing Aids at airports
  - Lighting | Airport Beacons | Visual Approach Slope Indicator (VASI) | Precision Approach Path Indicator (PAPI) | VFR and IFR | Instrument Landing System (ILS)
- Airspace at a glance
  - Classes of airspace
- Air Traffic Control (ATC) & Airport Radars

Exercise: Designing a Crude Attitude Measurement Equipment for an Aircraft.

DSA03 :: Introduction to Basic Terms of Aeronautics and Astronautics

Inspired from **AA100 Introduction to Aeronautics and Astronautics** - Stanford University BS Program in Aeronautics & Astronautics

- Introduction to the fundamental concepts of Physics
  - Air Pressure | Mass, Volume and Weight | Force | Density | Temperature | Fluid Friction | Drag Altitude | Sea level conditions
- How airplanes fly? | Spacecraft launch, and re-entry
- History of Aviation & The Evolution of flight

Exercise: Analysis of an Aircraft's Flight with respect to Different Flight Parameters.

DSA04 :: Atmospheric Flight

Inspired from **AA141 Atmospheric Flight** - Stanford University BS Program in Aeronautics & Astronautics

- Aerodynamics of flight
  - Forces acting on an aircraft | How wings generate lift? Newtonian Physics | Bernoulli's principle | Coanda Effect
- Airfoil Design
  - Introduction | Airfoil Terminology | NACA Airfoil and 4 digit series | Different types of an airfoil | Angle of attack and its impact on lift | Center of pressure & its impact on flight control | Wingtip vortex | Lift Coefficient

Exercise: Designing an Airfoil with Maximum Lift and Minimum Drag.

DSA05 :: Flight Mechanics and Controls

Inspired from **AA173 Flight Mechanics and Controls** - Stanford University BS Program in Aeronautics & Astronautics

- Introduction to terminologies in Aeronautics
  - Airplane axis and degree of freedom | Pitch, Yaw & Roll
- Control surfaces on an aircraft
  - Vertical & Horizontal Stabilizer | Aileron | Flaps & Slats | Airbrake/Spoilers | Rudder

- IForces acting on an aircraft, Moment of Force
- Lift formula, Lift coefficient and angle of attack
- Drag forces and its classification | Stall & Coffin Corner
- Principles of flight | Aspect Ratio | Angle of Attack
- How does an aircraft fly, climb and turn?
- Load factor of an aircraft | How helicopter fly?

Exercise: Designing & Building a Remote-controlled Aircraft.

DSA06 :: Space Flight Systems and Concepts

Inspired from **AA131 Space Flight** - Stanford University BS Program in Aeronautics & Astronautics

- What is Space and Karman line?
- Satellites | A Day in the Life of a NASA Satellite Team
- A tour of International Space Station (ISS)
- Can an airplane fly into space?
- Introduction to Orbital Dynamics – Part 1 (Going to moon) | Part 2 (Hohmann Transfer) | Part 3 (Interplanetary Travel) | Part 4 (The Oberth Effect)
- Spacecraft Attitude determination

Exercise: Designing a 'Hybrid' Plane which has Propulsion to Fly in Atmosphere as well as in Space.

DSA07 :: Air and Space Propulsion

Inspired from **AA103 Air and Space Propulsion** - Stanford University BS Program in Aeronautics & Astronautics

- Rockets 101 | The rocket science – All about Rockets
  - Rocket systems: Structural | Propulsion | Payload | Guidance | Brief history of rockets | Rocket staging
- An introduction to jet engine
- Rocket propulsion and types of rocket propulsion
  - Liquid | Solid | Hybrid | Multistage | Air breathing
- Future of propulsion
  - Electric Plasma Jet Engine | Nuclear Propulsion | Ion Engine | Plasma Thrust Experiment 1 & 2 | Solar sails | Laser Assisted Propulsion

Exercise: Designing a futuristic propulsion system.

DSA08 :: Guidance and Navigation

Inspired from **AA172 Guidance & Navigation** - Stanford University BS Program in Aeronautics & Astronautics

- An introduction to spacecraft Guidance, Navigation and Control Systems (GN&C)
- Case study: Missile Guidance System

Exercise: Designing a Navigation & Guidance Instruction Set.

DSA09 :: Space Mechanics

Inspired from **AA279A Space Mechanics** - Stanford University BS Program in Aeronautics & Astronautics

- Gravity and how it enables orbits | Orbit types
- Satellite orbit types & how satellite stay in the orbit
- Kepler's Laws | Launch, Propulsion and Re-entry
- Orbital Rendezvous and launch window:

Exercise: Designing a satellite system for 24x7 connectivity

DSA10 :: Introduction to Spacecraft Subsystems

Inspired from **AA136A Spacecraft Design** - Stanford University BS Program in Aeronautics & Astronautics

- Introduction to Spacecraft Subsystems

DSA11 :: Designing & Building a CubeSat

Inspired from **AA136A Spacecraft Design** - Stanford University BS Program in Aeronautics & Astronautics

- What is a CubeSat? | Space 2.0 and CubeSat
- Challenges in CubeSat Engineering – Propulsion
- An example of innovative CubeSat Propulsion
- Hardware and Software Design Challenges in a Spacecraft – a study with an example of SpaceX Falcon 9 & Dragon

Exercise: Designing a 'Nano Satellite' to Accomplish a Novel Application from Space.

DSA12 :: Aircraft Design

Inspired from **AA146A Aircraft Design** - Stanford University BS Program in Aeronautics & Astronautics

- A tour of aircraft structure, systems and avionics
- Aircraft Fuselage | Structure Types | Frames
- Aircraft design process | Requirement | Function | Wings & other surface geometry | Dimensions | Engines
  - Engineering Drawing and weight calculation
  - Control Surface Finalization | Aircraft wing design

Exercise: Designing the Most Efficient Airplane in the World.

DSA13 :: Avionics Systems – 1

- Introduction to Avionics and Fly by Wire system:
  - Principle drivers of avionics systems requirements
  - Avionics systems on a multipurpose aircraft
- Cockpit Display Systems | Primary Flight Display (PFD) | Multi-Function Display (MFD) | Engine Instrument and Crew Alert System (EICAS) | Case study: Boeing 737 and Gulfstream G550 Flight deck
- Future of Cockpit Display System

Exercise: Designing a Cockpit Display System to Prevent Human Error which could lead to Plane Crash.

DSA14 :: Avionics Systems – 2

- Flight Management System (FMS)
- Traffic Alert Collision Avoidance System (TCAS)
- Enhanced Ground Proximity Warning System (EGPWS)
  - Mode 1: Excessive Descent Rate
  - Mode 2: Excessive Closure to terrain
  - Mode 3: Altitude loss after takeoff
  - Mode 4: Unsafe terrain clearance
  - Mode 5: Excessive Glideslope Deviation
  - Mode 6: Advisory Callout/Bank Angle
  - Mode 7: Windshear Alerting

Exercise: Designing a 'Flying Bike' for Urban Transportation.