19ASO303 FUNDAMENTALS OF UAV

Unit-II - BASICS OF AIRFRAME

Topic- MODELLING

1. Structural Modeling

Finite Element Analysis (FEA)

Purpose:

Used to simulate how different parts of the airframe will respond to various loads and stresses.

Process:

The airframe is divided into smaller elements (finite elements) and analyzed to predict how these elements will behave under different conditions.

Applications:

Helps in identifying weak spots, optimizing material usage, and ensuring that the airframe can withstand operational loads.

Structural Analysis:

Static Analysis:

Determines how the airframe responds to steady loads, such as the weight of the aircraft and aerodynamic forces.

Dynamic Analysis:

Studies the effects of time-varying loads and vibrations on the airframe.

Fatigue Analysis:

Evaluates how repeated loading cycles can lead to material fatigue and potential failure.

2. **Aerodynamic Modeling**

Computational Fluid Dynamics (CFD):

Purpose:

Simulates the flow of air around the aircraft to analyze aerodynamic performance.

Process:

Uses numerical methods and algorithms to solve the equations governing fluid flow around the airframe.

Applications:

Helps in optimizing wing shapes, reducing drag, and improving overall aerodynamic efficiency.

Wind Tunnel Testing -

Purpose:

Provides experimental data on aerodynamic performance.

Process:

Models of the aircraft or its components are tested in a wind tunnel to measure forces and pressures.

Applications:

Validates CFD models and provides empirical data for design adjustments.

3. Dynamic Modeling:

Flight Dynamics

Purpose:Models the aircraft's motion and stability characteristics.

Process: Uses equations of motion to simulate how the aircraft responds to control inputs, disturbances, and environmental conditions.

-Applications: Helps in understanding and improving the aircraft's handling qualities and stability.