

| Course Title | Course Code | Credit Hours |
|--|--------------------|---------------------|
| Introduction to Rotorcraft Dynamics | AE-455 | 2-0 |

Textbooks:

- J. Gordon Leishman, "Principles of Helicopter Aerodynamics", Cambridge Aerospace Series
- John M. Seddon and Simon Newman, "Basic Helicopter Aerodynamics", Wiley

Reference Material:

- Aviation Maintenance Technician Certification Series, "Propeller"
- Aviation Maintenance Technician Certification Series, "Helicopter Aerodynamics, Structures and Systems"

Course Objectives:

This course aims to introduce students to Helicopter Aerodynamics, focusing on Rotor Dynamics in different flight modes. It includes Blade Element Analysis and basic performance assessment for foundational understanding.

Course Outline:

- Introduction to Rotary-Wing Aircraft and Their Technical History
- Definitions and Types of Rotorcrafts, Including Main and Tail Rotor Configurations
- Construction Methods and Materials for Wooden, Composite, and Metal Propellers
- Components of Propellers: Blade Station, Face, Shank, Back, and Hub Assembly
- Fixed Pitch, Controllable Pitch, and Constant Speed Propellers
- Propeller and Spinner Installation
- Control Systems: Collective, Cyclic, Directional, and Pitch Control with Over Speed Protection
- Fundamentals of Rotor Aerodynamics and Propeller Synchronizing Equipment
- Momentum Theory (Mt) For Hovering Flight: Induced Velocity, Thrust, and Power Coefficients

- Power Loading, Disk Loading, and Power Requirements; Figure of Merit and Solidity Ratio
- Blade Element Theory (Bet): Linearly and Ideally Twisted Blades, and Optimum Twisting
- Combined Blade Element Momentum Theory (Cbemt) and Prandtl's Tip Loss Function
- Performance Analysis in Vertical Climb, Descent, Vortex Ring State, and Windmill Brake State
- Autorotation and Forward Flight Performance Using Glauret's Flow Model
- Rotating Blade Motion: Rotor Reference Axis, Hub Plane, and Tip Path Plane
- Dynamics of Blade Flapping: Lead-Lag, Feathering, Coning Angle
- Propeller Ice Protection: Fluid and Electrical De-Icing Equipment
- Propeller Maintenance: Balancing, Blade Tracking, and Damage Assessment
- Propeller Storage, Preservation, and Depreservation