Course Title	Course Code	Credit Hours
Aerial Robotics	AE- 456	1-1

Textbooks:

- Frank L. Lewis, Brain L. Stevens " Aircraft Control and Simulation", Wiley
- S. Leutenegger, C. Huerzeler, A.K. Stowers, K. Alexis, M. Achtelik, D. Lentink, P. Oh, and R. Siegwart. " Flying Robots: Handbook of Robotics", Springer International

Reference Books/Materials:

- K. Valavanis, and P. Vachtsevanos, " Handbook of Unmanned Aerial Vehicles", Springer
- R. Beard, and T. W. McLain, " Small Unmanned Aircraft: Theory and Practice", Princeton University Press

Course Objectives:

This course aims to help students in understanding the following:

- Students to holistic design of autonomous aerial robots, focusing on UAV design, sensor-based data acquisition, and intelligent flight control.
- It covers hardware and software aspects of Autonomous Flight Stack implementation, including UAV dynamics, flight control, SLAM, path planning, and navigation, with an introduction to Robot Operating System and Flight Controllers.

Course Outline:

- Introduction to Aerial Robotics: Introduction, Background, Impact in Society and Challenges in Aerial Robotics
- Navigation Sensors: Classification of Sensors, Inertial Sensors, Magnetometers, Pressure Sensors, GPS, Time of Flight Sensors, LIDAR and SLAM
- Micro Aerial Vehicle Dynamics: MAV Dynamics and Propellers
- Coordinate Frames: Coordinate Frames, Rotation of Reference Frame, How to Represent Orientation and Robot Kinematics
- State Estimation: Sensor Model, Motion Model and Introduction to Probabilistic Robotics

- Flight Controls Introduction: Altitude, Position Control and Model Predictive Control
- PID Control: PID Controller Design for Micro Aerial Vehicles.
- Autopilot Study:2 D Case Study
- Aerial Robot Motion Plaining Planning: Trends in Motion Planning, Fundamental Problem of Path Planning, Coverage Path Planning and Rapidly Exploring Random Trees (RRTs) Algorithm.
- Aerial Robot Path Plaining Planning: Sampling Based Inspection Path Planning and Rapidly Exploring Random Tree of Trees (RRTOT)