AE-630: Autonomous Unmanned Aerial Systems (Semester II, 2015–16)

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Course Contents

- Introduction to Unmanned Aerial Vehicles (UAVs), types of UAVs, applications, design process and design goals
- Unmanned Aerial Systems: description of each sub-system and their roles
- Mission specific configuration selection, powerplant selection and preliminary design
- Aerodynamics and Performance, equation of motion and dynamics model
- Levels of autonomoy, autopilot architecture and design, stability and control analysis, linear control design, gain selection through experimentation, nonlinear control design, state estimation, sensor, actuator, telemetry
- Commercial-Off-The-Shelf (COTS) design and system integration
- Ground station, Microcontroller programming using Real Time Operating System (RTOS), Hardware-in-the-loop simulation (HILS), experimental procedures and flight testing
- Case studies: coaxial helicopter, quadrotor, fixed wing, conventional helicopter, innovative new concepts

References

1. Castillo, P., Lozano, R., and Dzul, A. E., *Modelling and Control of Mini-Flying Machines*, Springer, London, 2005.
2. Beard, R., and McLain, T., *Small Unmanned Aircraft: Theory and Practice*, Princeton University Press, 2012.
3. Mettler, B., *Identification Modeling and Characteristics of Miniature Rotorcraft*, Springer, 2003.
4. Shkarayev, S. V., Ifju, P. G., Kellogg, J. C., and Mueller, T. J., *Introduction to the Design of Fixed-Wing Micro Air Vehicles Including Three Case Studies*, AIAA Education Series, 2007.
5. Appriou, A., *Aerial Robotics*, Journal Aerospace Lab, Issue 8, December 2014.
6. Prouty, R. W., *Helicopter Performance, Stability, and Control*, Krieger Publishing Company, Florida, 1986.