TEACHING PLAN OF AAE4202 (2020-AUTUMN)

Instructor:	**Teaching Assistant:**	**Venue and time**:
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THEORY PART

W1. Introduction
- a. Course overview
- b. UAS definition and classification
- c. A brief history of UAS
- d. Some famous talks about UAS

W2. System components
- a. Systems introduction
- b. Airframe
- c. Actuator and power system
- d. Radio controller and Telemetry
- e. Ground Control Station (GCS)
- f. The flight controller (Details in Week 10)

W3. Coordinate system and attitude representation
- a. Introduction
- b. Coordinate systems
- c. Attitude representation
- *d. Assignment-1*

W4. Quadrotor modelling
- a. Kinematic model
- b. Dynamic model
- c. Model linearization
- d. Control allocation model
- e. Propulsion system model
- f. Parameter measurement

W5. Quadrotor control
- a. PID control
- b. Cascade control structure
- c. Position control
- d. Attitude control
- e. Control allocation

W6. Path planning 1
- a. High-level planner overview
- b. Space and map representations
- c. Search-based planning methods
- *d. Assignment-2*

W7. Path planning 2 and Trajectory generation
- a. Sample-based method
- b. Trajectory generation with polynomial function
- *c. Midterm Test*

IMPLEMENTATION PART

W8. MATLAB, Simulink, and Flight simulation
- a. Software Introduction and Access Methods
- b. Programming with MATLAB
- c. Programming with Simulink
- d. Flight simulation in MATLAB/Simulink
- *e. Individual Mini-Project Release (3 Weeks)*

W9. Introduction to Autopilot
- a. Introduction to Autopilot
- b. Pixhawk, PX4 and ArduCopter
- c. Flight controller hardware and sensors
- d. Flight stack firmware

W10. Flight simulation and ROS
- a. Flight simulation introduction
- b. PX4 simulation environment
- c. Software-in-the-loop simulation and hardware-in-loop simulation
- d. Robot operation system (ROS) and MAVROS
- e. Realtime operation system (RTOS)
- f. Demonstration
- g. *Case study and group presentation Release (3 Weeks)*

W11. Virtual Lab (How to build your quadrotor UAS?)
- a. Hardware selection and assembling
- b. Firmware selection and upload
- c. Initial setting and calibrations
- d. First flight and flight mode
- e. VICON motion capture system tutorial

W12. Advanced topic and Outlook
- a. Advanced topic
- b. Outlook
- c. Conclusion

W13. Case study group presentation
- *a. Case study report*
- *b. Group presentation*

Assessment type

(a) Weighting of this course: 100% Continuous assessment (Due to the pandemic)

(b) Continuous assessment (CA)

Assignments	(20%)
Test	(20%)
Mini project	(30%)
Case study and presentation	(30%)

References

1. Quan, Quan. *Introduction to multicopter design and control*. Springer, 2017
2. Kenzo Nonami et al, Autonomous flying robots: unmanned aerial vehicles and micro aerial vehicles, Springer, 2010.
3. Donald Norris, Build your own quadcopter: power up your designs with the Parallax Elev-8, New York: McGraw-Hill Education, 2014