# Subject Description Form

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| **Subject Code** | AAE4202 |
| **Subject Title** | Electronics & Information Technologies for Unmanned Aerial Systems |
| **Credit Value** | 3 |
| **Level** | 4 |
| **Pre-requisite/ Co-requisite/ Exclusion** | Nil |
| **Objectives** | To provide students with knowledge of electronics and information technologies for unmanned aerial vehicles (UAV) and unmanned aircraft systems (UAS). |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to:<br>a. Possess all required concepts and skills related to the remote control and primary autonomous unmanned aircraft systems; and<br>b. Apply the learnt concepts and skills to operate, maintain and perform diagnosis on existing unmanned aircraft systems; and<br>c. Extend their knowledge to analyze and develop new modules or algorithms in unmanned aircraft systems for desired needs. |
| **Subject Synopsis/ Indicative Syllabus** | **System Component, Electronic Device, and Radio Link**<br>Common system components of UAS: airframe, servo, propulsion system (motor, electronic speed controller (ESC), propeller), Li-po battery, radio transmitter and receiver, telemetry, ground control station (GCS), and the autopilot.<br>**Dynamic Modelling of Unmanned Aerial Vehicle**<br>Coordinate systems, kinematic model, dynamic model, propulsion system model, controller allocation model of UAS and model linearization method.<br>**Flight Control Framework**<br>Cascade control structure, position control, attitude control, and control allocation for the low-level control of UAS.<br>**Path and Trajectory Planning**<br>Global path planning for UAS including search-based methods and sample-based methods. Local smooth trajectory generation methods.<br>**Autopilot System Integration and Flight Simulation**<br>Open-source flight controller; Flight simulation platform; Programming and hardware interface; Implementation of control and planning algorithms, Introduction to autonomous aerial robotic system. |

**Teaching/Learning Methodology**

1. The teaching and learning methods include lectures/hands on sessions, assignments, test, mini project and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for unmanned aircraft systems.
3. Technical/practical examples and problems are raised and discussed in class/hands on sessions.

| Teaching/Learning Methodology | Intended subject learning outcomes to be covered | | |
|---|---|---|---|
| | a | b | c |
| 1. Lecture | ✓ | ✓ | |
| 2. Hands on | ✓ | ✓ | |
| 3. Assignment | ✓ | ✓ | |
| 4. Mini project | ✓ | ✓ | ✓ |

**Assessment Methods in Alignment with Intended Learning Outcomes**

| Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed | | |
|---|---|---|---|---|
| | | a | b | c |
| 1. Assignments | 15 % | ✓ | ✓ | |
| 2. Test | 15 % | ✓ | ✓ | |
| 3. Mini Project | 30 % | ✓ | ✓ | ✓ |
| 4. Examination | 40 % | ✓ | ✓ | ✓ |
| Total | 100% | | | |

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.4 × End of Subject Examination + 0.6 × Continuous Assessment

The continuous assessment consists of three components: homework assignments, test, and case study. They are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt. The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

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| **Student Study Effort Expected** | Class contact: | |
| | ▪ Lecture | 27 Hrs. |
| | ▪ Hands on | 12 Hrs. |
| | Other student study effort: | |
| | ▪ Self-Study | 22 Hrs. |
| | ▪ Mini project | 44 Hrs. |
| | Total student study effort | **105 Hrs.** |
| **Reading List and References** | 1. Quan, Quan. Introduction to multicopter design and control. Springer, 2017<br>2. Kenzo Nonami et al, Autonomous flying robots: unmanned aerial vehicles and micro aerial vehicles, Springer, 2010.<br>3. Donald Norris, Build your own quadcopter: power up your designs with the Parallax Elev-8, New York: McGraw-Hill Education, 2014 | |

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