



POLITÉCNICA

INTERNATIONAL
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingeniería y Sistemas
de Telecomunicación

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

595010250 - Drone Fundamentals And Applications

DEGREE PROGRAMME

59TL - Grado En Ingeniería Telemática

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	595010250 - Drone Fundamentals And Applications
No of credits	4.5 ECTS
Type	Optional
Academic year of the programme	Fourth year
Semester of tuition	Semester 8
Tuition period	February-June
Tuition languages	English
Degree programme	59TL - Grado en Ingeniería Telemática
Centre	59 - Escuela Técnica Superior De Ingeniería Y Sistemas De Telecomunicación
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jesus Rodriguez Molina (Subject coordinator)		jesus.rodriquezm@upm.es	- -

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- It is expected from the students that they will have a good grasp of Java programming

4. Skills and learning outcomes *

4.1. Skills to be learned

CE TEL07 - Conocimiento y utilización de los fundamentos de la programación en redes, sistemas y servicios de telecomunicación.

CE TL07 - Capacidad de programación de servicios y aplicaciones telemáticas, en red y distribuidas.

CG 03 - Capacidad para expresarse correctamente de forma oral y escrita y transmitir información mediante documentos y exposiciones en público.

CG 04 - Capacidad de abstracción, de análisis y de síntesis y de resolución de problemas.

CG 05 - Capacidad de trabajo en equipo y en entornos multidisciplinares.

CG 11 - Habilidades para la utilización de las Tecnologías de la Información y las Comunicaciones.

CG 13 - Habilidades de aprendizaje con un alto grado de autonomía.

4.2. Learning outcomes

RA1089 - Conocer las aplicaciones en el ámbito civil de los vehículos aéreos no tripulados

RA1086 - Conocer las características básicas de los vehiculos aereos no tripulados

RA1088 - Comprender los principios de funcionamiento de los vehículos aéreos no tripulados

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

5.2. Syllabus

1. Introduction to UAVs
 - 1.1. Operating and piloting principles
 - 1.2. Basic regulation applicable to unmanned aircraft
 - 1.3. Other theoretical concepts
2. Introduction to UAV simulation and forecasting
 - 2.1. Introduction to simulators and digital twins
 - 2.2. Introduction to AirSim
 - 2.3. Usage examples
3. Fundamentals of flying with drones
 - 3.1. Main components of a drone
 - 3.2. Sensors and payload

3.3. Communications links

3.4. Flight control. Main maneuvers

4. Training of UAV / drone pilots

4.1. Basic principles of system control

4.2. Indoor and outdoor location procedures

4.3. Introduction to image processing for detection and guidance

4.4. Other concepts

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Lesson 1 Duration: 03:00 Lecture		Lesson 1 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
2	Lesson 1 Duration: 03:00 Lecture		Lesson 1 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
3	Lesson 1 Duration: 03:00 Lecture		Lesson 1 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
4	Lesson 2 Duration: 02:00 Lecture	Lesson 2 Duration: 01:00 Laboratory assignments	Lesson 2 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
5	Lesson 2 Duration: 01:00 Laboratory assignments	Lesson 2 Duration: 02:00 Laboratory assignments	Lesson 2 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
6		Lesson 2 Duration: 03:00 Laboratory assignments	Lesson 2 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
7	Lesson 3 Duration: 01:00 Lecture			First partial exam Written test Continuous assessment Presential Duration: 02:00
8	Lesson 3 Duration: 01:00 Lecture	Lesson 3 Duration: 02:00 Laboratory assignments	Lesson 3 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
9		Lesson 3 Duration: 03:00 Laboratory assignments	Lesson 3 (if applicable due to COVID-related restrictions) Duration: 00:00 Additional activities	
10		Lesson 3 Duration: 03:00 Laboratory assignments	Lesson 3 (if applicable due to COVID-related restrictions) Duration: 00:00 Additional activities	

11	Lesson 4 Duration: 02:00 Lecture	Lesson 4 Duration: 01:00 Laboratory assignments	Lesson 4 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
12	Lesson 4 Duration: 01:00 Lecture	Lesson 4 Duration: 02:00 Laboratory assignments	Lesson 4 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
13		Lesson 4 Duration: 03:00 Laboratory assignments	Lesson 4 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
14		Lesson 4 Duration: 03:00 Laboratory assignments	Lesson 4 (if applicable due to COVID-related restrictions) Duration: 03:00 Additional activities	
15				Second partial exam Written test Continuous assessment Presential Duration: 03:00 Exam "final-only" itinerary Written test Final examination Not Presential Duration: 03:00
16				
17				Team use case presentation Group presentation Continuous assessment and final examination Presential Duration: 03:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	First partial exam	Written test	Face-to-face	02:00	25%	0 / 10	CE TEL07 CE TL07 CG 04 CG 11 CG 13
15	Second partial exam	Written test	Face-to-face	03:00	25%	0 / 10	CG 03 CE TL07 CG 04 CG 11 CG 13
17	Team use case presentation	Group presentation	Face-to-face	03:00	50%	0 / 10	CE TEL07 CE TL07 CG 04 CG 05 CG 11 CG 13 CG 03

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Exam "final-only" itinerary	Written test	No Presential	03:00	50%	0 / 10	CG 03 CE TL07 CG 04 CG 11 CG 13
17	Team use case presentation	Group presentation	Face-to-face	03:00	50%	0 / 10	CE TEL07 CE TL07 CG 04 CG 05 CG 11 CG 13 CG 03

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary exam	Written test	Face-to-face	04:00	100%	5 / 10	CG 03 CE TEL07 CE TL07 CG 04 CG 05 CG 11 CG 13

7.2. Assessment criteria

The continuous assessment system will be the one that is applied by default to all students of the subject. However, the student will be able to choose between two assessment itineraries, exclusive and definitive: continuous assessment itinerary and final exam only itinerary.

Continuous evaluation itinerary:

It is the default itinerary. The student must work continuously throughout the semester and must submit the practical works in a mandatory manner within the established deadlines. The teacher can give feedback on the work done and ask to repeat part of the entire practice. Failure to deliver practices on time or non-repetition of the parts of a practice that a teacher requests will be penalized with 3 points less in the corresponding midterm exam (the first if the non-delivery is one of the Attendance to class is highly recommended, Since concepts will be explained and implementation works closely related to the practices and questions that will be asked in the exams will be developed. The fundamental objective of continuous assessment is that students study and understand the main concepts of the subject gradually. For this reason, it is considered that the systematic work that includes carrying out exercises on the contents studied in the theoretical classes is of special importance. To pass the subject it will be necessary to achieve a minimum grade of 5 points in the final grade.

Final test only itinerary

In this itinerary, no continuous evaluation test will be carried out, but the students must deliver the laboratory practical works in the same terms as the others, and will incur the same penalties in case they do not deliver or do not redo the requested parts of the practices. The final grade will be calculated from the grade obtained in a single evaluation test, divided into a theory part and a laboratory part. To pass the course, the student must obtain at least

5.0 points in each of the two parts. As in the continuous assessment, to pass the subject it will be necessary to achieve a minimum grade of 5 points in the final grade.

Extraordinary exam

To take the extraordinary exam, the student must have completed the laboratory practices. In this exam all the contents of the subject will be evaluated. Passing will be achieved with a minimum grade of 5 points.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Ar Drone 2.0	Equipment	Commercial UAV used as practical platform
AirSim	Bibliography	Simulator oriented towards drones
Drone piloting course	Bibliography	UAS / drone pilot training in categor Open

9. Other information

9.1. Other information about the subject

The health situation caused by the COVID-19 pandemic forces to restrict the capacity of the classrooms and therefore it has been decided that, if necessary, the teaching model for this semester can be hybrid or mixed. In-person shifts will be established within the groups, so that each week one shift will attend class in the classroom (column "classroom activity" of the schedule), while the rest of the shifts will be connected to the class electronically (column "tele-enseñanza" [tele-teaching]). And each week it will be a different shift who goes to the classroom.

If sanitary conditions change and face-to-face classes could be taught normally, all students will go to classrooms to receive the classes indicated in the column "Actividad en clase [classroom activity]". If, on the contrary, the sanitary conditions worsened, all the students would go on to connect to the remote classes of the column "tele-enseñanza[tele-teaching]".