



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S.I en Topografía, Geodesia
y Cartografía

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

123000645 - Geospatial Solutions On Internet

DEGREE PROGRAMME

12AC - Master Universitario en Ingeniería Geodesica y Cartografía

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

Index

Learning guide

1. Description.....	1
2. Faculty.....	1
3. Prior knowledge recommended to take the subject.....	2
4. Skills and learning outcomes	2
5. Brief description of the subject and syllabus.....	3
6. Schedule.....	7
7. Activities and assessment criteria.....	10
8. Teaching resources.....	11
9. Other information.....	13

1. Description

1.1. Subject details

Name of the subject	123000645 - Geospatial Solutions On Internet
No of credits	4.5 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	12AC - Master Universitario en Ingeniería Geodesica y Cartografía
Centre	12 - E.T.S.I en Topografía, Geodesia y Cartografía
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Rufino Perez Gomez (Subject coordinator)	436	rufino.perez@upm.es	M - 16:30 - 19:30 Tu - 10:30 - 13:30

* 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

- Inglés medio para el seguimiento de las clases

4. Skills and learning outcomes *

4.1. Skills to be learned

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE1 - Capacidad de diseño, elaboración, dirección y gestión de proyectos geomáticos científico-técnicos

CE13 - Gestionar, divulgar y estructurar la información geográfica al más alto nivel, analizando las colecciones de datos, sus niveles de medida y su disposición por el territorio

CE3 - Dominio de herramientas informáticas de aplicación a los sistemas avanzados de información geográfica

4.2. Learning outcomes

RA56 - Comprender los flujos de trabajo de las ?soluciones geoespaciales? e identificar cada uno de sus componentes

RA160 - Modelización y análisis espacial con herramientas GIS 3D

RA62 - Entender y aplicar la integración y diseminación de los datos y resultados de proyectos GIS en aplicaciones de Internet del tipo Google Earth (GE) o Microsoft Virtual Earth (MVE).

RA159 - Modelizar flujos de análisis espacial y producción cartográfica. Conocer y aplicar conceptos y escenarios de análisis diversos con las herramientas GIS (análisis vectorial, raster, 3d,etc)

RA60 - Aplicar los conceptos de Cartografía y GIS (vistos en asignaturas del Grado) en flujos relacionados con Internet.

RA63 - Planificar y diseñar las fases y tareas del flujo de trabajo de un proyecto (solución geográfica) aplicando los conceptos y herramientas aprendidos

* 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

ENGLISH

The main purpose of this course is to study different concepts and techniques dealing with "3D Modeling and Analysis with 3D GIS and Google Earth"

The course combines the modeling, analysis, mapping and visualization tools of GIS Desktop (ArcGIS 3D Analyst V10.X) with the capabilities to publish and visualize data in Internet of Google Earth

The course is structured in 3 main components:

- Theoretical aspects: They are explained in 10 chapters or themes (see the programme)

- Practical, methodological and technological aspects. They are managed through around 40 practical exercises and workflows
- Final project of this course with a methodology of "learning based on projects"

SPANISH

La asignatura tiene por objeto el estudio de técnicas de "Modelización y Analisis con herramientas de GIS 3D y Google Earth".

Integra las capacidades de modelización, análisis y visualización de las herramientas GIS desktop 3D (ArcGIS 3D Analyst V10.X) y la publicación de datos en Internet con Google Earth.

La asignatura se estructura en 3 componentes esenciales:

- Aspectos Teóricos. Se exponen en 10 temas.
- Aspectos prácticos, metodológicos y tecnológicos. Se desarrollarán a través de alrededor de 40 ejercicios prácticos y flujos de trabajo.
- Trabajo de la asignatura con la metodología de "aprendizaje basado en proyectos".

5.2. Syllabus

1. Theme 1: Introduction to 3D Modeling with GIS an Google Earth

- 1.1. Introduction: 3D Maps and 3D Analyst
- 1.2. Components of 3D Analyst
- 1.3. 3D Data categories
- 1.4. Surface and Features to model reality
- 1.5. 2.5 and 3D dimensional data

2. Theme 2: Display in 3D environment

- 2.1. General properties of 3D environment: vertical exaggeration, coordinate system, illumination, and background color
- 2.2. Layer properties concerned with height: Base heights and Extrusions

- 2.3. Other layer properties: Symbology, Display, Shading, Drawing priority
- 3. Theme 3: 3D Navigation and Animation
 - 3.1. Targets and observers
 - 3.2. View settings
 - 3.3. Movies that show changes in scene properties and layer properties
 - 3.4. Animated Rotation and Flight Simulation
 - 3.5. Movies that show changes in perspective and along a path
- 4. Theme 4: Visualization on virtual globes: ArcGlobe
 - 4.1. General concepts about 3D display and analysis in globe systems
 - 4.2. Globe Properties and General settings of the environment
 - 4.3. Globe Layer types: elevation, draped and floating layers
 - 4.4. Global and Surface Navigation Modes
 - 4.5. Navigation tools and 3D perspectives in virtual globes
 - 4.6. Spin tools and animated rotation
- 5. Theme 5: Raster Surface Models
 - 5.1. Basic concepts: interpolation, spatial autocorrelation, sample size, interpolation barriers
 - 5.2. Interpolation Methods: Inverse Distance Weighted (IDW), Spline, Kriging, and Natural Neighbors
 - 5.3. Surface Analysis Methods: Slope, Aspect, Hillshade and Viewshed
 - 5.4. Raster Reclassifications
 - 5.5. Raster Analysis techniques
- 6. Theme 6: TIN Surface Models
 - 6.1. Basic concepts and triangulation methods
 - 6.2. Surface feature types
 - 6.3. TIN Creation and modification
 - 6.4. TIN Simbolization and Classification Methods
- 7. Theme 7: Terrain Surface Models
 - 7.1. Basic concepts and application scenarios
 - 7.2. Multipointf features and terrain pyramid levels
 - 7.3. Displaying and working with terrains

7.4. Terrain conversion to Raster and TIN models

8. Theme 8: 3D Features and More Surface Analysis Techniques

8.1. 3D features creation and conversion. 3D Digitizing

8.2. Steepest Paths and Lines of sight

8.3. Cross-section profile graphs

8.4. Area and volume calculations

8.5. Multipatch 3D features

9. Theme 9: Google Earth

9.1. Online virtual globes

9.2. Interface : panels, toolbar and navigation controls

9.3. Placemarks, Paths, Polygons and Image overlays

9.4. Measuring, Routing and Recording of Tours

9.5. KML language

10. Theme 10: Publishing GIS data on Google Earth

10.1. SketchUP 3D modeling application

10.2. Data conversion between Google Earth, Google SketchUp and ArcGIS

10.3. Publishing GIS maps and layers on Google Earth

10.4. Publishing 3D GIS data on Google Earth

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1			<p>Presentation of the course Duration: 00:15 Additional activities</p> <p>Theoretical Class Theme 1 Duration: 01:45 Lecture</p> <p>Practical Exercises Theme 1 Duration: 02:00 Laboratory assignments</p>	
2			<p>Theoretical Class Theme 2 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 2 Duration: 02:00 Laboratory assignments</p>	
3			<p>Theoretical Class Theme 3 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 3 Duration: 02:00 Laboratory assignments</p>	
4			<p>Theoretical Class Theme 4 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 4 Duration: 02:00 Laboratory assignments</p>	
5			<p>Theoretical Class Theme 5 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 5 Duration: 02:00 Laboratory assignments</p>	
6			<p>Theoretical Class Theme 5 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 5 Duration: 02:00 Laboratory assignments</p>	

7			<p>Theoretical Class Theme 6 Duration: 01:00 Lecture</p> <p>Practical Exercises Theme 6 Duration: 01:00 Laboratory assignments</p>	<p>Theoretical Exam Block1 (T1-T5) Online test Continuous assessment Not Presential Duration: 01:30</p>
8			<p>Theoretical Class Theme 6 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 6 Duration: 02:00 Laboratory assignments</p>	
9			<p>Theoretical Class Theme 7 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 7 Duration: 02:00 Laboratory assignments</p>	
10			<p>Theoretical Class Theme 8 Duration: 02:00 Lecture</p> <p>Practical Exercises Theme 8 Duration: 02:00 Laboratory assignments</p>	
11			<p>Theoretical Class Themes 9 and 10 Duration: 02:00 Lecture</p> <p>Practical Exercises Themes 9 and 10 Duration: 02:00 Laboratory assignments</p>	
12			<p>Project Choice and Design Duration: 01:00 Lecture</p> <p>Development of the Course Project Duration: 01:00 Laboratory assignments</p>	<p>Theoretical Exam Block2 (T6-T10) Online test Continuous assessment Not Presential Duration: 01:30</p>
13			<p>Development of the Course Project Duration: 04:00 Laboratory assignments</p>	
14			<p>Development of the Course Project Duration: 04:00 Laboratory assignments</p>	
15			<p>Development of the Course Project Duration: 04:00 Laboratory assignments</p>	
16				<p>PRESENTATION AND DEFENSE OF THE COURSE PROJECT Individual work Continuous assessment Not Presential Duration: 01:30</p>

17				<p>FINAL THEORETICAL EXAM Written test Final examination Presential Duration: 02:00</p> <p>FINAL PRACTICAL EXAM OR COURSE PROJECT Individual work Final examination Presential Duration: 02:00</p>
----	--	--	--	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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	Theoretical Exam Block1 (T1-T5)	Online test	No Presential	01:30	30%	3 / 10	CE13 CE3 CB10
12	Theoretical Exam Block2 (T6-T10)	Online test	No Presential	01:30	30%	3 / 10	CE3 CB10 CE13
16	PRESENTATION AND DEFENSE OF THE COURSE PROJECT	Individual work	No Presential	01:30	40%	3 / 10	CE1 CB10 CE13 CE3

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	FINAL THEORETICAL EXAM	Written test	Face-to-face	02:00	60%	3 / 10	CE3 CB10 CE13
17	FINAL PRACTICAL EXAM OR COURSE PROJECT	Individual work	Face-to-face	02:00	40%	3 / 10	CE3 CE1 CB10 CE13

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

EVALUATION CRITERIA

- Results of the first theoretical exam (themes 1-5) = 30 %
- Results of the second theoretical exam (themes 6-10)= 30 %
- Evaluation of the quality of the presentation and defence of the course project (databases, implementations, oral presentation, written memory, etc).= 40 %

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Lectures Notes of Theoretical Classes	Bibliography	Lectures notes with the theoretical classes prepared by the teacher
Lectures Notes of Practical Exercises	Bibliography	Lectures notes with the practical exercises and workflows
Introduction to 3D Data: Modeling with ArcGIS 3D Analyst and Google Earth	Bibliography	Heather Kennedy, K. (2009). "Introduction to 3D Data: Modeling with ArcGIS 3D Analyst and Google Earth". Wiley. Referencia Principal de la asignatura.
ESRI: ArcGIS Tutorials and Reference manuals	Bibliography	Tutorials and Reference manuals of ArcGIS Desktop and 3DAnalyst extension
Google Sketchup Cookbook: Practical Recipes and Essential Techniques	Bibliography	Bonnie Roskes (2009): Google Sketchup Cookbook: Practical Recipes and Essential Techniques. O'Reilly Media. Libro de consulta

Cartography: Visualization of Spatial Data	Bibliography	Kraak, M-J and Ormeling, F (2010). Cartography: Visualization of Spatial Data. The Guilford Press. Libro de Consulta
GIS Tutorial II: Spatial Analysis Workbook	Bibliography	Allen, D. (2009). "GIS Tutorial II: Spatial Analysis Workbook". Esri Press. Libro de consulta
Cartography: Thematic Map Design	Bibliography	Dent, B., Torgusson, J. and Hodler, T. (2008). "Cartography: Thematic Map Design". McGraw-Hill. Libro de consulta
Mastering ArcGIS with CD Videoclips	Bibliography	Price, M. (2009). Mastering ArcGIS with CD Videoclips (4 edition). McGraw-Hill. Libro de consulta
Maps and the Internet	Bibliography	Peterson, M.P. (Editor) (2005). "Maps and the Internet". Elsevier Science. Libro de consulta
Perspectives on Maps and the Internet	Bibliography	Peterson, M.P. (Editor) (2009). "International Perspectives on Maps and the Internet". Springer Berlin Heidelberg. Libro de consulta
Beginning Google Maps Applications with PHP and Ajax: From Novice to Professional	Bibliography	Purvis, M., Sambells, J. and Turner, C. (2006). "Beginning Google Maps Applications with PHP and Ajax: From Novice to Professional". Apress. Libro de consulta
Geospatial Services and Applications for the Internet	Bibliography	Sample, J.T, Shaw, k, Shengru, T, and Abdelguerfil, M. (Editors) (2008). "Geospatial Services and Applications for the Internet". Springer.. Libro de consulta
Beginning Google Maps Mashups with Mapplets, KML, and GeoRSS	Bibliography	Udell, S. (2008). "Beginning Google Maps Mashups with Mapplets, KML, and GeoRSS: From Novice to Professional?". Apress. Libro de consulta
Cybercartography: Theory and Practice	Bibliography	Taylor, D.R.F. (2006). "Cybercartography: Theory and Practice". Elsevier Science. Libro de consulta

GOOGLE EARTH,GOOGLE SKETCHUP AND KML TUTORIALS AND VIDEOS:	Web resource	http://www.google.com/earth/learn/ http://sketchup.google.com/ http://code.google.com/intl/es-ES/apis/kml/documentation/kml_tut.html http://www.youtube.com/googleearth/
Software ArcGIS 10.4	Equipment	Programa de GIS (ArcGIS 10.1) instalado en laboratorio + Licencia temporal para prácticas de los alumnos en casa.
Software libre Google Earth	Equipment	Programa Instalado en el laboratorio para la realización de prácticas.
Software Google SketchUp 8	Equipment	Programa Instalado en el laboratorio para la realización de prácticas.
Acceso a Internet	Equipment	Acceso a Internet para las búsquedas bibliográficas y la realización de prácticas.

9. Other information

9.1. Other information about the subject

INFORMATION ABOUT THE EVALUATION OF THE COURSE

For the continuous evaluation, online evaluation methods will be applied. However, according to the agreements and guidelines of the UPM governing board, approved on June 25, 2020, the final or ordinary evaluation of this course will be on-site, or face-to-face evaluation. The students who do not live in Spain will be evaluated with Oral exams

If the sanitary situation, or restrictions to mobility are applied, and the exams can be conducted on-site, new guidelines and recommendations will be delivered at the right time.

COMMUNICATION

The students and the teachers can communicate each other regularly via email or the Moodle course of the subject.

PLATFORMS

- MOODLE: to store the contents of the course and other aspects of communication and interaction (messages, chats, tasks, questionnaires, etc..)
- MICROSOFT TEAMS: for private or group tutoring. It is also an alternative for online education and teaching in case it were required for the pandemy
- UPM DRIVE o ONE DRIVE: to exchange large datasets o to submit final projects