ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

565005801 - Advanced Mathematics In Engineering

DEGREE PROGRAMME

56IQ - Grado En Ingeniería Química

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2

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Learning guide

1. Description

1.1. Subject details

Name of the subject	565005801 - Advanced Mathematics In Engineering
No of credits	3 ECTS
Type	Optional/elective
Academic year ot the programme	Fourth year
Semester of tuition	Semester 8
Tuition period	February-June
Tuition languages	English
Degree programme	56IQ - Grado en Ingeniería Química
Centre	56 - E.T.S. De Ingeniería Y Diseño Industrial
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Maria Helena Cobo Pablos (Subject coordinator)		helena.cobo@upm.es	- -
Benjamin Bode		benjamin.bode@upm.es	Sin horario.

* 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

- Algebra Lineal

- Calculo Infinitesimal

3.2. Other recommended learning outcomes

- Calculus and linear algebra

4. Skills and learning outcomes *

4.1. Skills to be learned

CE 1 - Capacidad para la resolución de los problemas matemáticos que puedan plantearse en ingeniería. Aptitud para aplicar los conocimientos sobre: Álgebra lineal, geometría, geometría diferencial, cálculo diferencial e integral, ecuaciones diferenciales y en derivadas parciales, métodos numéricos y algorítmica numérica

CG 1 - Conocer y aplicar los conocimientos de ciencias y tecnologÃas bÃ¡sicas a la prÃ¡ctica de la IngenierÃa Industrial

CG 10 - Creatividad.

CG 2 - Poseer la capacidad para diseñar, desarrollar, implementar, gestionar y mejorar productos, sistemas y procesos en los distintos ámbitos industriales, usando técnicas analíticas, computacionales o experimentales apropiadas

CG 3 - Aplicar los conocimientos adquiridos para identificar, formular y resolver problemas en contextos amplios, siendo capaces de integrar los trabajando en equipos multidisciplinares

CG 5 - Comunicar conocimientos y conclusiones, tanto de forma oral como escrita, a públicos especializados y no especializados de modo claro y sin ambigüedades

CG 6 - Poseer las habilidades de aprendizaje que permitan continuar estudiando a lo largo de toda la vida para un desarrollo profesional adecuado

CG 7 - Incorporar las TIC y las tecnologías y herramientas de la Ingeniería Industrial en sus actividades profesionales

4.2. Learning outcomes

RA426 - RA122 - Capacidad para conocer, entender y utilizar los principios de cálculo diferencial en varias variables.

* 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

The goal of this course is to provide an introduction to differential geometry, which has many applications in engineering and science. Differential geometry allows us to analyze the shape of geometric objects. We will focus on the cases of curves and surfaces.

5.2. Syllabus

1. Mathematical background

2. Curves

3. Surfaces

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**Mathematical background** Duration: 02:00 Lecture			
2	**Curves** Duration: 02:00 Lecture			
3	**Curves** Duration: 01:00 Lecture **Problems on curves** Duration: 01:00 Problem-solving class			
4	**Curves** Duration: 02:00 Lecture			
5	**Curves** Duration: 01:00 Lecture **Problems on curves** Duration: 01:00 Problem-solving class			
6	**Curves** Duration: 02:00 Lecture			
7	**Curves** Duration: 01:00 Lecture **Problems on curves** Duration: 01:00 Problem-solving class			**Problems on curves** Individual work Progressive assessment Not Presential Duration: 00:00
8	**Curves** Duration: 02:00 Lecture			
9	**Surfaces** Duration: 02:00 Lecture			
10	**Surfaces** Duration: 02:00 Lecture			

11	**Surfaces** Duration: 01:00 Lecture **Problems on surfaces** Duration: 01:00 Problem-solving class			
12	**Surfaces** Duration: 02:00 Lecture			
13	**Oral presentations** Duration: 02:00 Additional activities			**Oral presentations** Individual presentation Progressive assessment Presential Duration: 02:00
14	**Surfaces** Duration: 02:00 Lecture			**Problems on surfaces** Individual work Progressive assessment Not Presential Duration: 00:00
15	**Written exam** Duration: 02:00 Additional activities			**Written exam** Written test Progressive assessment Presential Duration: 02:00
16				
17				**Written exam** Written test Global examination Not Presential Duration: 02:00

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.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Problems on curves	Individual work	No Presential	00:00	10%	/ 10	CG 1 CG 10 CG 3 CG 2 CG 6 CE 1
13	Oral presentations	Individual presentation	Face-to-face	02:00	20%	/ 10	CG 7 CG 5
14	Problems on surfaces	Individual work	No Presential	00:00	10%	/ 10	CG 10 CG 1 CG 3 CG 2 CG 6 CE 1
15	Written exam	Written test	Face-to-face	02:00	60%	/ 10	CG 1 CG 10 CG 3 CG 2 CG 6 CE 1

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Written exam	Written test	No Presential	02:00	100%	5 / 10	CG 1 CG 10 CG 3 CG 2 CG 6 CE 1

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

There are different ways to pass this course:

1- Progressive assessment. It consists of submission of solved exercises (20%), small oral presentations (20%) and a written exam (60%).

2- If the student does not pass the progressive assessment, they will have the opportunity to take a written exam in June/July (100%).

3- In case of failing 1 and 2, there will be another opportunity with a written exam (100%).

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Parametric geometry of Curves and Surfaces, Alberto Lastra	Bibliography	(2021) Birkhäuser
Differential geometry and its visualization, Eberhard Malkowsky, Cemal Dolicanin, Vesna Velickovic	Bibliography	(2024) CRC Press
Differential Geometry of Curves and Surfaces, M.P. do Carmo	Bibliography	(2016) Dover
Architectural geometry, H. Pottmann, A. Asperl, M. Hofer and A. Kilian	Bibliography	(2013) Bentley Int. Press