



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001

ingeniería
diseño
industrial

E.T.S. de Ingeniería y Diseño
Industrial

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

565005801 - Advanced Mathematics In Engineering

DEGREE PROGRAMME

56IM - Grado En Ingeniería Mecánica

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2

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.....	5
7. Activities and assessment criteria.....	7
8. Teaching resources.....	9

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 of the programme	Fourth year
Semester of tuition	Semester 8
Tuition period	February-June
Tuition languages	English
Degree programme	56IM - Grado en Ingeniería Mecánica
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

CE1 - 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.

CG1 - Conocer y aplicar los conocimientos de ciencias y tecnologías básicas a la práctica de la Ingeniería Industrial

CG10 - Creatividad.

CG2 - 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

CG3 - Aplicar los conocimientos adquiridos para identificar, formular y resolver problemas en contextos amplios, siendo capaces de integrar los trabajando en equipos multidisciplinares

CG5 - Comunicar conocimientos y conclusiones, tanto de forma oral como escrita, a públicos especializados y no especializados de modo claro y sin ambigüedades.

CG6 - Poseer las habilidades de aprendizaje que permitan continuar estudiando a lo largo de toda la vida para un desarrollo profesional adecuado

CG7 - Incorporar las TIC y las tecnologías y herramientas de la Ingeniería Industrial en sus actividades profesionales.

4.2. Learning outcomes

RA381 - RA151 - 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: 00:00
14	Surfaces Duration: 02:00 Lecture			Problems on surfaces Individual work Progressive assessment Not Presential Duration: 02:00
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	CE1 CG1 CG2 CG3 CG10 CG6
13	Oral presentations	Individual presentation	Face-to-face	00:00	20%	5 / 10	CG5 CG7
14	Problems on surfaces	Individual work	No Presential	02:00	10%	/ 10	CE1 CG1 CG2 CG3 CG10 CG6
15	Written exam	Written test	Face-to-face	02:00	60%	/ 10	CE1 CG1 CG2 CG3 CG10 CG6

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	CE1 CG1 CG2 CG3 CG10 CG6

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