Course guide
320055 - EG - Engineering Graphics

Last modified: 02/04/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 717 - DEGD - Department of Engineering Graphics and Design.

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Francisco Bermúdez Rodríguez

Others: Francisco Bermúdez Rodríguez
Marc Rodríguez Novas
Paula Bermúdez Mas

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
4. MEC: Knowledge and capability for implementing engineering Graphics techniques.

Transversal:
1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

TEACHING METHODOLOGY

- Face-to-face lecture and exercise sessions.
- Face-to-face practical sessions.
- Independent study, exercises, research and analysis of information.
- Preparation and completion of graded group activities.

LEARNING OBJECTIVES OF THE SUBJECT

· Upon completion of this subject, students will have acquired: An understanding of the rules and representation systems used in mechanical design, as well as the spatial awareness needed to interpret the various plans that graphically document a project.
· An understanding of the standard and non-standard elements related to mechanical design that will enable the creation and design of various mechanisms using a series of different CAD applications.
· The knowledge required to graphically design any project.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	45,0	30.00
Hours large group	15,0	10.00

Total learning time: 150 h

CONTENTS

TOPIC 1: TYPES OF TECHNICAL DRAWINGS AND CONTENT

Description:
01.01.Drawings of industrial products: assembly and breakdown drawings.
01.02.Standardised elements.
01.03.Graphic representation of equipment and industrial installations.
01.04.Graphic representation in civil engineering.
01.05.Graphic representation of industrial designs.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 2: SURFACE FINISHES AND SYMBOLS

Description:
02.01.Classification of surfaces.
02.02.Roughness: concept and characteristic parameters.
02.03.Surface finish symbols.
02.04.Indication of surface finish on drawings. UNE-1037-83.
02.05.Indication of knurled surfaces. DIN-82.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 3: DIMENSIONAL TOLERANCES AND FITS

Description:
03.01.Introduction to tolerances and interchangeability.
03.02.Tolerance: concept and characteristic parameters.
03.03.Representation of tolerances for limits, deviations and classes.
03.04.Quality and position of tolerances.
03.05.General and preferred tolerances.
03.06.Dimensional transfer.
03.07.Fit: concept, representation and indication.
03.08.Types of fits and parameters.
03.09.ISO fit systems: hole-base and shaft-base.
03.10.Preferred fits.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 4: GEOMETRIC TOLERANCES

Description:
04.01.Tolerance zone
04.02.Indication on the drawings
04.03.References and reference elements
04.04.Others indications
04.05.Interpretation of the different geometric tolerances
04.06.General geometric tolerances
04.07.Relationship between dimensional and geometric tolerances
04.08.Application criteria and regulations

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 5: STANDARDISED ELEMENTS OF THREADED FASTENERS

Description:
05.01.Thread systems and threaded elements.
05.02.Screws, bolts, studs, threaded rods, nuts, washers, lock washers and circlips.
05.03.Dimensional characteristics and geometric shapes.
05.04.Standard designation.
05.05.Standard tables of elements.
05.06.Standard representation of threaded elements and fasteners.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 6: STANDARDISED ELEMENTS OF NON-THREADED FASTENERS

Description:
06.01.Cylindrical pins, tapered pins, split pins, pins with threaded or elastic ends.
06.02.Pins and pegs.
06.03.Dimensional characteristics and geometric shapes.
06.04.Standard designation.
06.05.Standard tables of elements.
06.06.Standard representation of elements and fasteners.
06.07.Representation of elements in assembly drawings.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 7: : DRIVE SHAFTS

Description:
07.01.Standard geometries and dimensions.
07.02.Graphic representation of drive shafts.
07.03.Cylindrical and conical shaft ends (DIN 748 and DIN 1448).
07.04.Splined, grooved and ribbed shafts. Standards and graphic representation.
07.05.Representation of elements in assembly drawings.

Full-or-part-time: 5h
Theory classes: 0h 30m
Laboratory classes: 1h 30m
Self study : 3h

TOPIC 8: SPRINGS

Description:
08.01.Classification of springs by shape, coil cross-section and type of load.
08.02.Representation and design according to UNE-EN ISO 2162.
08.03.Multiview, cross-section and simplified representation of: tension springs, compression springs, torsion springs, spiral springs and bow springs.
08.04.Table of spring characteristics.
08.05.Representation of springs in assembly drawings.

Full-or-part-time: 5h
Theory classes: 0h 30m
Laboratory classes: 1h 30m
Self study : 3h

TOPIC 9: FRICTION BEARINGS AND ROLLING-ELEMENT BEARINGS

Description:
09.01.Representation and design of friction bearings.
09.02.Rolling-element bearings: components, types, types of loads and size series.
09.03.Characteristics, regulations, standard designation and specific graphic representation of rolling-element bearings: rigid ball bearings, angular contact ball bearings, floating ball bearings, cylindrical-roller bearings, tapered-roller bearings, floating roller bearings, axial ball bearings and needle bearings.
09.04.General and specific simplified representation of each type.
09.05.Radial and axial mounting of bearings. Graphic representation and design.
09.06.Bearing seals. Graphic representation according to geometry and design.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 10: GEAR-DRIVEN TRANSMISSIONS

Description:
10.01. Types: cylindrical with straight teeth, cylindrical with helical teeth, conical, worm and crown gears
10.02. Fundamental graphic dimensions and parameters. Definitions
10.03. Characteristics and dimensions
10.04. Standard representation of the different types of gear
10.05. Table of characteristics of a cogwheel

Full-or-part-time: 40h
Theory classes: 4h
Laboratory classes: 12h
Self study : 24h

TOPIC 11: CHAIN-, CABLE- AND BELT-DRIVEN TRANSMISSIONS

Description:
11.01.Types.
11.02.Basic graphic magnitudes and parameters. Definitions.
11.03.Characteristics and dimensions.
11.04.Standard and simplified representation.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 12: CAMS AND ECCENTRIC WHEELS

Description:
12.01.Definitions.
12.02.Eccentric wheels. Types and laws of motion.
12.03.Graphic determination of an eccentric wheel. Layout.
12.04.Cams. Standard layout and representation.

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 13: WELDING

Description:
13.01.Classification of welding procedures.
13.02.Representation of welds. Graphic and symbolic representation.
13.03.Designation of welded joints.
13.04.Standard UNE-EN 22553:1994 on the representation of welded joints.

Full-or-part-time: 5h
Theory classes: 0h 30m
Laboratory classes: 1h 30m
Self study : 3h

TOPIC 14: REPRESENTATION OF SHEET-METAL PART FORMATION

Description:
14.0.Sheet metalworking.
14.02.Development.
14.03.Bending formulas.
14.04.Deformation operations.

Full-or-part-time: 5h
Theory classes: 0h 30m
Laboratory classes: 1h 30m
Self study : 3h

GRADING SYSTEM

A continuous assessment model will be in place, with the basic goal of taking into account students' ability to work both independently and in teams.
Knowledge acquisition, competencies and skills are assessed as follows:
- Individual and group work throughout the year: 50%
- Final exam for the course: 50%.
For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

EXAMINATION RULES.

Since the proposed methodological approach is based on continuous assessment practices and having a significant relative weight in the final grade, attendance, conduct and delivery of practices (on time for each of them) is considered mandatory. A practical assistance to less than 80% of the planned sessions, means that students can not be assessed in the same. The final grade of students with these characteristics correspond exclusively to the results in the examinations of the course.

BIBLIOGRAPHY

Basic:
- Félez, Jesús; Martínez, María Luisa. Dibujo industrial. 3a ed. Madrid: Síntesis, 1999. ISBN 8477383316.
- Auria Apilluelo, J.M.; Ibáñez Carabantes, P.; Ubieto Artur, P. Dibujo industrial: conjuntos y despieces. 2a ed. Madrid [etc.]: Paraninfo, 2005. ISBN 9788497323901.
- French, M. J. Conceptual design for engineers [on line]. 3rd ed. London: The Design Council, cop. 1999 [Consultation: 14/11/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3073885. ISBN 1852330279.
- Giesecke, Frederick E. Technical drawing. 13th ed. Upper Saddle River, New Jersey [etc]: Pearson Prentice Hall, cop. 2009. ISBN 9780135135273.
- Ramos Barbero, Basilio; García Maté, Esteban. Dibujo técnico [on line]. 3a ed. Madrid: AENOR, 2016 [Consultation: 14/11/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6774114.
- Jensen, Cecil Howard; Helsel, Jay D.; Short, Dennis R. Dibujo y diseño en ingeniería. 2ª ed. México [etc.]: McGraw-Hill, cop. 2004. ISBN 970103967X.
- Rodríguez de Abajo, F.J.; Galarraga Astibia, R. Normalización del dibujo industrial. San Sebastián: Donostiarra, 1993. ISBN 8470631810.

Complementary:

- Espinosa Escudero, M.M.; Domínguez Somonte, M. Expresión gráfica y diseño asistido en ingeniería. Madrid: Asociación de Ingeniería y Diseño Asistido, DL 2010. ISBN 9788461357710.
- Espinosa Escudero, M.M.; Domínguez Somonte, M. Fundamentos de dibujo técnico y diseño asistido. Madrid: Universidad Nacional de Educación a Distancia, cop. 2002. ISBN 9788436243482.

RESOURCES

Other resources:
Students enrolled in the subject have access to the course material prepared by the teaching staff at Atenea.