



Universitat de Lleida

DEGREE CURRICULUM
**PLANNING, PROGRAMMING
AND CONTROL**

Coordination: COMA ARPON, JULIA

Academic year 2023-24

Subject's general information

Subject name	PLANNING, PROGRAMMING AND CONTROL			
Code	101421			
Semester	UNDEFINED / 1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Architectural Technology and Building Construction	3	COMPULSORY	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRAULA		TEORIA
	Number of credits	3		3
	Number of groups	1		1
Coordination	COMA ARPON, JULIA			
Department	INDUSTRIAL AND BUILDING ENGINEERING			
Teaching load distribution between lectures and independent student work	40% at the classroom, 60% autonomous work. See the "Development plan".			
Important information on data processing	Consult this link for more information.			
Language	Catalan			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COMA ARPON, JULIA	julia.coma@udl.cat	6	

Subject's extra information

The planning, scheduling and control techniques presented in this course are closely related, therefore it is essential a continuous work for a correct learning. This subject combines the theoretical and practical approaches. It is essential to make the exercises that will be proposed in class. This work can be supplemented by recommended bibliography.

Subject of the 3rd degree course. It belongs to the module "Specific Training", specifically to the subject "Managing of the process".

Learning objectives

- Construct the PERT chart for a probabilistic planning of the building and to calculate the probability of achieving the specified deadlines.
- Scheduling a building with minimum cost using MCE.
- Resource allocation and leveling in the program of a building.
- Track and correct the deviations in the planning using review and control techniques.
- Making a temporal scheduling of the building using the critical path method (CPM).
- Apply the Roy technique to planning a building with overlaps and shifts between activities.
- Making and interpret Gantt charts applied to the planning of construction.
- Use informatic tools to apply programming techniques.

Competences

University of Lleida strategic competences

- UdL3 Mastering ICT's.

Cross-disciplinary competences

- EPS2. Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.
- EPS7. Capacity to work in situations with a lack of information and/or under pressure.
- EPS8. Capacity of planning and organizing the personal work.
- EPS13. Capacity to consider the socioeconomic context as well as the sustainability criteria in engineering solutions.

Specific competences

- GEE25. Capacity to schedule and manage the building process, the work teams, and the technical and

human means for maintenance and execution.

- GEE26. Knowledge of building legislation, contractual relationships in the different phases of a building process. Furthermore, knowledge of the legislation and other specific rules regarding security and occupation healthcare issues in buildings.
- GEE27. Aptitude to write studies, basic studies and security and labour health plans, and coordinate the security in a project and executive phases of a construction work.
- GEE28. Capacity for the quality management in construction works, the writing, application, implantation and update of manuals and quality plans, to perform quality management audits in companies and to edit the book of the building.
- GEE29. Aptitude to analyse, design and execute solutions that allow the universal access to buildings and surroundings.
- GEE30. Knowledge of professional work organization and studies organization, offices and professional societies, the regulation and the legislation related with the functions that develop a Building Engineer and the legal framework of responsibility associated to the activity.

Subject contents

1. Introduction to planning and scheduling in construction.

- 1.1 General concepts about planning, scheduling and control.
- 1.2 Classification of planning and scheduling techniques.
- 1.3 Methods based on graph theory.

2. CPM: Critical Path Method.

- 2.1 Duration of activities in CPM.
- 2.2 Early and last times.
- 2.3 Slack time.
- 2.4 Critical activities and critical path.
- 2.5 Construction of the CPM network.

3 PERT: Program Evaluation and Review Technique.

- 3.1 Probabilistic calculation of time in PERT: β distribution.
- 3.2 Probabilistic calculation of deadline in PERT: normal distribution.
- 3.3 Construction of the PERT network.

4. Roy Method.

- 4.1 Background and comparison with CPM and PERT methods.
- 4.2 Basic principles of representation.

- 4.3 Construction of the network in Roy.
- 4.4 Calculation of minimum time, maximum time and slack time.
- 4.5 Overlap and displacement of activities.
- 4.6 Equivalence between networks: conversion from PERT to Roy.

5. The Gantt chart.

- 5.1 Background and main features..
- 5.2 Construction of the Gantt chart.
- 5.3 Advantages and limitations.
- 5.4 Representation of a network with the Gantt chart.

6. MCE: Minimum Cost Expediting Method.

- 6.1 Relationship between the cost and the duration of an activity.
- 6.2 Methodology for the reduction of a project.
- 6.3 Optimization of the duration with heuristic algorithms: Ackoff and Sasieni.

7. Project scheduling with limited resources.

- 7.1 Types of resources.
- 7.2 The problem of limited resources.
- 7.3 Resource leveling.
- 7.4 Resource assignment.

8. Tracking the program.

- 8.1. Progress of the activities.
- 8.2 Tracking of the program with Gantt charts.
- 8.3 Tracking of the program with S curves.
- 8.4 Measurement of the project activity.

9. Program control and review.

- 9.1 Main techniques for control and review.
- 9.2 Procedure for control of a program.

Methodology

- **Lectures:** Classes to explain the theory and problem solving on the blackboard.
- **Resolution of problems:** Students solve problems individually during these sessions under the supervision of teachers of the subject.
- **Delivery of exercises:** Students deliver exercises proposed by the teacher (to solve in class or at home), who corrects and returns it to the student.
- **Practices:** To schedule projects using the software available in the computer laboratory.
- **Exam:** Two written tests are held during the semester. There is also a final retrieval test.

Development plan

Week	Methodology	Contents	Hours at classroom	Hours of autonomous work
1	Lectures Resolution of problems Delivery of exercises	T1. Introduction	4	6
2	Lectures Resolution of problems Delivery of exercises	T2. Critical Path Method	4	6
3-4	Lectures Resolution of problems Delivery of exercises	T3. PERT Method	8	12
5	Lectures Resolution of problems Delivery of exercises	T4. Roy Method	4	6
6	Lectures Resolution of problems Delivery of exercises	T5. The Gantt chart	4	6
7-8	Lectures Resolution of problems Delivery of exercises	T6. MCE Method	8	12
9	1st test of evaluation (exam)	T1 to T5	2	
11-12	Lectures Resolution of problems Delivery of exercises	T7. Project scheduling with limited resources	8	12
12	Practices	MS Project	2	3
14	Lectures Resolution of problems Delivery of exercises	T8. Tracking the program	2	3
14	Practices	MS Project	2	3

15	Classes magistrals Lectures Resolution of problems Delivery of exercices	T9. Program control and review	2	3
15	Pràctiques	MS Project	2	3
16-17	2nd test of evaluation (exam)	T1 to T9	2	
19	Retrieval test	All the contents of the subject	2	

Evaluation

Evaluation Activities		%	Dates
Block 1	PA 1. Written exam	30	Week 9th
Block 2	PA 2. Written exam	45	Week 16th and 17th
Block 3	Exercices at class/home	25	Along the semester
	Recovery Exam	75	Week 19th

Exam Notes:

- During weeks 9 and 17/18, the scheduled evaluation tests (written exams) will be conducted: BLOCK 1: PA1 and BLOCK 2: PA2. Each of these tests carries a weight of 30% and 45% respectively towards the final grade.
- To consider the exercise grade (25%), you must score at least 4 out of 10 on the written exams (average of both exams).
- Following the guidelines of the Academic Framework of EPS Degrees, during the 19th week, individuals who have not passed the subject will have the opportunity to recover their grade through continuous evaluation for the semester. There is no option to improve the grade on the PA1 and PA2 tests. The recovery will be done through a written examination covering the entire course content and carrying a weight of 75% towards the final grade. To consider the exercise grade (25%), you must score at least 4 out of 10 on this recovery test. The maximum grade that can be obtained in the recovery test is 6.9 (Pass).

Exercise Grade:

- Throughout the course, students will be given a series of exercises to solve in class. At the end of the class, and as determined by the teacher, students must submit the solutions to the assigned exercises.
- Additionally, students must individually complete exercises assigned by the teacher at home, and these must be submitted by the specified deadlines.
- The exercise grade accounts for 25% of the final grade for the subject and is calculated as the average of the grades assigned to the various exercises throughout the course.
- Completing all exercises is mandatory. Students must submit the exercise solutions on paper or through the virtual campus tool called "Actividades propuestas". Failure to submit an exercise or submitting it after the deadline will result in a grade of 0. This grade cannot be modified by submitting another exercise.

Alternative Evaluation:

- An alternative evaluation will be conducted through a written examination covering the entire course content and carrying a weight of 75% towards the final grade. A minimum grade of 4 is required to be averaged with the grade of the submitted exercises.
- The series of exercises assigned throughout the semester via the virtual campus in the "Activities" section will be submitted on the agreed-upon dates. Each exercise holds the same value, and the average of the grades obtained will represent 25% of the subject's value. Failure to submit an exercise or submitting it after the deadline will result in a grade of 0. This grade cannot be modified by submitting another exercise.

Alternative Evaluación Alternativa	%	Dates
Single Test. Written Exam	75	Week 17th/18th
Exercises submitted	25	Week 9th and Week 18th
Recovery Exam	75	Week 19th

Bibliography

BASIC BIBLIOGRAPHY

- Capuz Rizo, S. et al., Cuadernos de Ingeniería de Proyectos III: Dirección, Gestión y Organización de Proyectos. Servicio de Publicaciones Universidad Politecnica de Valencia, 2000.
- Pomares Martinez, J., Planificación Gráfica de Obras. Ed. Gustavo Gili, Barcelona, 1977.
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COMPLEMENTARY BIBLIOGRAPHY

- Chatfield, C., Johnson, T., Microsoft Project 2010 Step by Step. Microsoft Press, 2010.
- Lopez Valera, P., Iglesias Baniela, S., Planificación, Programación y Control de Proyectos mediante Técnicas de Camino Crítico. Ed. Torculo, Santiago de Compostela, 2007.
- Mateos Perera, J., La Programación en la Construcción: el PERT en versión completa. Ed. Bellisco, Madrid, 2003.
- Mattos, Aldo D. Métodos de planificación y control de obras: del diagrama de barras al BIM. Ed. Reverté, Barcelona, 2014.
- Ponz Tienda, J.L., Project Management con redes PERT. Universidad Politecnica de Valencia, 2008.