

## 29824 - Programmable Electronic Systems

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 29824 - Programmable Electronic Systems

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

326 - Escuela Universitaria Politécnica de Teruel

**Degree:** 330 - Complementos de formación Máster/Doctorado

440 - Bachelor's Degree in Electronic and Automatic Engineering

444 - Bachelor's Degree in Electronic and Automatic Engineering

**ECTS:** 10.0

**Year:** 440 - Bachelor's Degree in Electronic and Automatic Engineering: 3

444 - Bachelor's Degree in Electronic and Automatic Engineering: 3

330 - Complementos de formación Máster/Doctorado: XX

**Semester:** Annual

**Subject type:** 440 - Compulsory

330 - ENG/Complementos de Formación

444 - Compulsory

**Module:**

### 1. General information

The objective of Programmable Electronic Systems (SEP) is to train in the design and programming of electronic systems with microprocessors, constituting what is called an embedded system. The student will learn to design, build and implement microprocessor-based electronic circuits and program the control algorithms.

It is an annual subject, taught by two departments, Electronics and Communications Engineering (SEP I, fall) and Computer and Systems Engineering (SEP II, spring). To take SEP the student must know how to program (Fundamentals of computer science) and have sufficient knowledge of Fundamentals of Electronics, Digital Electronics and Automatic Systems.

These approaches are aligned with the Sustainable Development Goals of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>) contributing to targets 8.2 (Goal 8) and 9.5 (Goal 9).

### 2. Learning results

- Distinguish the types of memory circuits and interpret a memory map.
- Understand the structure and basic operation of a microprocessor.
- Recognize microcontrollers, DSPs and FPGAs as the most useful programmable devices in industrial electronics.
- Program programmable electronic devices and use their development tools with ease.
- Know basic peripheral connection techniques, design its circuits and program low-level drivers.
- Design and verify digital electronic systems.
- Know how to apply time management techniques in the programming of real time systems.
- Know how to apply the implementation techniques of discrete and sampled control systems.
- Know the problems of a concurrent application.
- Know how to design and program an embedded real-time application.

### 3. Syllabus

#### 1st semester (SEP I)

##### Digital Electronic Systems (Dept. of Electronic Engineering and Communications)

- Basic concepts of microprocessor systems.
- Architecture and blocks of a commercial microcontroller.
- Assembler programming.
- Programming in C language.
- Inputs and Outputs: connection with electronic devices.
- Serial communications.
- Design of digital electronic systems.

#### 2nd semester (SEP II).

##### Embedded Systems Programming (Dept. of Computer Science and Systems Engineering)

- Embedded systems development tools based on C.

- Time management and specialized peripherals.
- Programming of discrete control systems.
- Programming of sampled control systems.
- Concurrent applications. Cyclical executives.
- Real-time cores and priorities.

#### 4. Academic activities

- Participative lectures (50 hours).
- Problem and case classes (25 hours)
- Practices (25 horas). The student will prepare the practice beforehand. In the session the student will assemble, program and test the operation of microcontroller-based electronic circuits.
- Teaching assignments (40 hours). Activities that the student will carry out alone or in groups and that the teacher will propose throughout the term.
- Personal study and work (100 hours).
- Assessment tests (10 hours)

In addition, at the Polytechnic University School of Teruel, a subject project will be proposed that will serve as a common thread.

#### 5. Assessment system

Annual subject divided into two parts, **SEP I (fall) and SEP II (spring), to be passed separately.**

**Final SEP grade = 0.6\*SEP\_I + 0.4\*SEP\_II.**

Overall assessment through the Laboratory Practicals and Written Examination activities listed below.

**Laboratory Practices** (SEP\_I EINA and EUPT, and SEP\_II EINA: 40%; SEP\_II EUPT: 75%).

- Grading in the laboratory session and/or by exam. The previous preparation and the work of student in the session will be valued.
- In addition, additional **evaluable activities** of a practical nature may be carried out: assignments, tests, etc. Each year will be specified in Moodle.
- Failure to attend a practice or activity at the scheduled time, or not submitting the deliverable on the established date, implies a grade of 0 in that activity.
- Whoever does not achieve a **minimum of 4 out of 10** in the total of the practical part of the subject (laboratory practicals and activities) will have to pass an **individual laboratory exam** within the framework of the official call (oral, written or in the format indicated).

**Written exam** (SEP\_I EINA and EUPT, and SEP\_II EINA: 60%; SEP\_II EUPT: 25%).

A **minimum of 4 out of 10** must be obtained. SEP I and SEP II will be evaluated separately on the dates established by the center (normally SEP I in January, SEP II in May, and both in the extraordinary call in June).