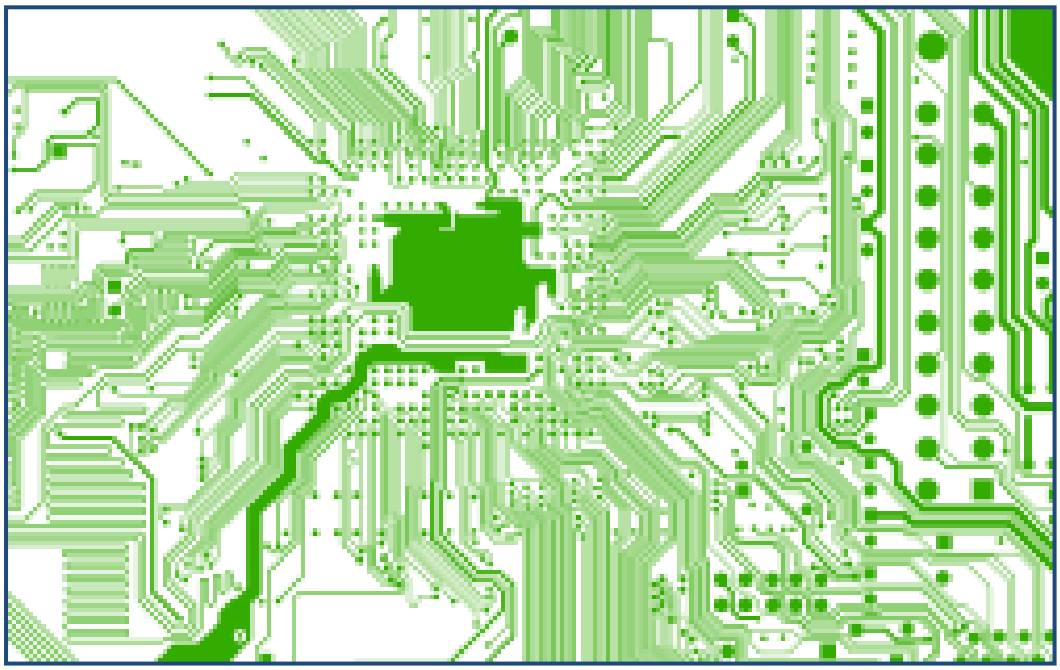
ANALOGUE AND DIGITAL ELECTRONICS

LESSON PLANS



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These lesson plans have been designed for Catalan secondary education schools, for the Technology classes at 4th ESO. In the lesson plans, the learning outcomes, key skills, content and the assessment criteria refer to the Catalan curriculum framework. As they are CLIL materials, you can also find the 4Cs: cognition, communication, culture and the content which we already had.

ain unit: Analogue and digital electronics.	**Time: 15 h**
• Unit 1: Introduction to electronics. ▪ Electricity and electronics. ▪ Past, present and future of electronics. ▪ From analogue to digital electronic systems.	3 h
• Unit 2: Analogue electronics. ▪ Resistors. ▪ Capacitors. ▪ Diodes. ▪ Transistors. ▪ Building real circuits. (optional 3 h)	6 h
• Unit 3: Digital electronics. ▪ The binary numeral system. ▪ Boolean logic. Logic gates. ▪ Logic circuit design. ▪ Simulation work. (optional 3 h)	4 h
• Revision, assessment.	2 h

UNIT 1: **INTRODUCTION TO ELECTRONICS**	*Subject:* **TECHNOLOGY**	*Timing:* **3 h**	*Level*: **15-16 y.o**.

TEACHING AIMS: to enable learners to understand electronics technology developed in the last century; to develop learners' abilities to think of electronic systems in terms of signals and block diagrams; to raise awareness of the effect of the electronics on society, health and the environment.

Learning outcomes. (Students will …)	*Key skill, cross-curricular links*	*Assessment criteria*
know ... what an electronic system is and does. ... the main facts in the history of electronics. ... what analogue and digital signals are. **be able to** ... differentiate electronic from electrical systems. ... identify the basic blocks in any electronic system. ... compare analogue and digital signals. **be aware** ... that electronic development has an impact on human wellbeing and society in general. ... of the risk that electronic products pose for our health and the environment.	Linguistic: Interaction with other people. Give accounts on facts. Methodological: Transform information into knowledge. Personal: decision taking with creative thinking. Personal and social: predict consequences and take reflective action. ***History:*** *history of electronics.* ***Science:*** *recycling.*	**Can the learners** ... draw a basic block diagram? ... place on a time line main developments in electronics and explain what consequences they had? ... explain what the problem with e-waste is? ... distinguish and compare analogue and digital systems?

Content	*Cognition*	*Communication*		*Culture*
		Language of	***Language for***	
Main developments and consequences in history of electronics. Block diagrams for electronic systems. Analogue and digital signals/systems.	Defining electronics. Sequencing facts. Identifying blocks. Classifying signals. Predicting consequences. Thinking creatively for e-waste solution. Comparing digital-analogue.	Electronic devices. Electronic systems: transistor, IC, vacuum tube, block, signal, input, output, analogue, digital, wave. I think it is a... because... It was invented in... Its applications are... We all should... It converts ... to ...	Giving reasons for classifications. Stating facts about technological developments. Suggesting solutions to problems. Describing block diagrams. Sharing ideas.	Electronics technology as a uniform global culture. E-waste has become a global problem.

UNIT 2: ANALOGUE ELECTRONICS	*Subject: TECHNOLOGY*	*Timing: 6 h*	*Level: 15-16 y.o.*
TEACHING AIMS: to enable learners to understand basic analogue electronic circuits, identify their components and build them.			

Learning outcomes. (Students will …)	*Key skill, cross-curricular links*	*Assessment criteria*
know ... the function and symbols of basic electronic components. ... the main electronic magnitudes, their multiples and submultiples and the laws that link them. **be able to** ... identify the basic electronic components. ... predict how an electronic circuit works. ... build basic circuits respecting the safety rules. **be aware** ... of the importance of basic electronic components to build more complex systems. ... of the standards in components, units, symbols, schematics in the global field of electronics.	Communicative: Express facts and thoughts in both written form and interact to check and do activities. Methodological: Access and communicate information using graphs. Analyse, synthesise, make inferences and deduct at different levels of complexity. Personal: develop and assess individual and collective activities with responsibility. ***Maths:*** *formulae calculations, graphs.* ***Physics:*** *electricity, Ohm's law.*	**Can the learners** ... get the value of a resistor? ... list the different types of resistors, draw their symbols and explain possible applications? ... calculate voltage in simple voltage dividers? ... describe and calculate charge and discharging of a capacitor in RC circuits? ... calculate currents in circuits with diodes and resistors? ... explain how a transistor works in a circuit, both as a switch or as an amplifier ... build simple circuits and evaluate them?

Content	*Cognition*	*Communication*		*Culture*
		Language of	***Language for***	
Resistors: colour code, Ohm's law, types and use in voltage dividers. Capacitor: units, charge and discharges graphs, time constants. Diodes: function and identification, current calculation. LEDs. Transistors: current formulae, binary and analogue circuits.	Identify and name parts of components. Calculate electrical magnitudes. Predict and sequence actions and consequences in circuits. Compare digital and analogue applications of a transistor. Reason and explain circuits. Combine components to design basic circuits. Plan actions to build circuits. Assess own and partner's work.	Electronic magnitudes: V, I, R. Electronic components and parts: anode, lead, base, emitter, etc. Components and circuits: wires, switches..., its value..., voltage across..., connected to.... Proportions: the more, the less... First, then.... If... then, when... Formulae, over, by, equals... Because, causes...	Expressing mathematical relationships and operations. Linking actions and consequences. Describing components and circuits. Explaining how electric circuits work. Predicting effects of changes in circuits.	Symbols and diagrams are a global language for electronics. Adoption of new English words for electronics in all languages.

UNIT 3: DIGITAL ELECTRONICS	*Subject: TECHNOLOGY*	*Timing: 4 h*	*Level: 15-16 y.o.*

TEACHING AIMS: to introduce binary numeral system; to enable learners to use logic gates to implement Boolean logic and design basic systems.

Learning outcomes. (Students will …)	*Key skill, cross-curricular links*	*Assessment criteria*
know ... the binary numeral system. ... the main Boolean operations and the corresponding gates. ... the standard symbols for logic circuits. **be able to** ... convert from binary to decimal and vice-versa. ... add simple binary numbers. ... use logic operators in expressions and circuits. ... use simulation software to analyse and design logic circuits. **be aware** ... of the importance of Boolean logic in decisions. ... of the convenience of electronic binary circuits to implement binary operations.	Communicative: Express and interpret logic reasoning. Methodological: Access, communicate and put into practice logic processes using maths expressions, diagrams and ICT. Personal: develop and assess individual and collective activities. ***Maths:*** numeral systems. ***ICT:*** software simulation.	**Can the learners** ... convert between decimal and binary? ... add binary numbers? ... operate using Boole algebra. ... translate logical expressions to gates? ... obtain truth tables from a logic system? ... design logic circuits in order to solve simple technological problem? ... use simulators to analyse logic systems?

Content	*Cognition*	*Communication*		*Culture*
		Language of	***Language for***	
Binary numeral system. Binary number addition. Logic operators, gates and truth tables. Technologies for logic gates. Logic systems and logic circuits. Logic circuit design. Digital electronics simulation.	Recall logic gate symbols. Reason logic circuit function. Divide big logic circuits into basic operations. Design logic circuits. Identify logic functions in many forms. Evaluate own and partner's work	Binary: true/false, on/off, high/low... Logic expressions: and, or, either, both, if, unless... Gate symbols and circuits: input/output , to feed, values... Truth tables: rows, combinations, columns... ICT instructions: open a file, click on, save...	Arithmetic operations. Describe Venn diagrams. Describing symbols and logic diagrams. Express logic conditions to describe logic systems. Operating a computer.	Symbols and diagrams are a global language for electronics. International standardisation organisations.