CU 9.4: INDUSTRIALISATION OF TIMBER PRODUCTS AND PROCESSES

Director of studies: Pierre-Jean MÉAUSOONE

General CU objectives:

• Analyse industrial design approaches: the production of industrial products relies heavily on methods that incorporate technical, economic, and organisational approaches
In this resource, we are mainly interested in the methods used in the context of a call for tenders, industrial innovation and the resolution of critical problems.

• Deepen the Design and Manufacturing methods of a timber product using robots: in order to better coordinate the actions to be carried out within the methods and manufacturing functions, students will work in a digital modelling approach on the advanced design of timber structures and the integration of robotics in manufacturing.
For this, we will rely on software dedicated to the management of robotic tools.

• Characterise and monitor manufacturing processes: the analysis of productions on a machine is an indispensable tool in the management of a manufacturing site. To do this, it is necessary to know the means of measurement and methods of qualification of a manufacturing process.

Consists of:

- Part 1: Industrial techniques of system engineering
- Part 2: Advanced CAM methods for construction
- Part 3: Advanced production techniques (robotisation)
- Part 4: Optimisation of production processes

Hourly volume

In-person	*Self-directed study*
28.75 H Lectures	**50.00 H**
64.00 H Tutorials	
0.00 H Practicals	

Positioning of the CU in the School reference system:

after semester 8

Units of skills

In accordance with the RNCP sheet

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Part 1: Industrial techniques of system engineering	**Coefficient 1**
Session leaders: Nicolas MAILLY (NMPROD SAS company), Marc GAUVENT (GUILLEN company)	
Teaching assistants:	
Prerequisites: none	
Teaching materials: Course notes – Reading list – Project	
Assessment methods: individual File - Practical examination	

Learning outcomes	**Description**	**Number of student hours (in-person)**		
		Lectures	**Tutorials**	**Practicals**
Innovatively solve an old or critical problem (product, service, process or organisation). Generate, evaluate and dare to propose an innovative response during an industrial call for tenders. Implement an innovative design project within a manufacturing company	– Presentation of the improvement process within a company – Description of resolution methods – Implementation: from an industrial problem, implement the methods, define and explain the solutions	**2.75**	**5.00**	
	– Development of innovative solutions to respond to an industrial call for tenders – Presentation of the approach through real-life cases – Methodological and human approach	**1.75**	**6.00**	
	– Implementation approach – From a production problem, design and provide an answer to a customer's request – Modify or change an existing product – Production launch and project planning	**2.75**	**5.00**	
		7.25	**16.00**	**0.00**

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Part 2: Advanced CAM methods for construction	**Coefficient 1**
Session leaders: Anis BOUALI, Alain RENAUD	
Teaching assistants: Julien LALLEMAND	
Prerequisites: none	
Teaching materials: Course notes – Presentation slides – Project	
Assessment methods: individual Report - File	

Learning outcomes	**Description**	**Number of student hours (in-person)**		
		Lectures	**Tutorials**	**Practicals**
Know how to analyse the needs and define the constituent elements of the digital model and BIM. Master a programming environment dedicated to robotics: know how to implement modern means of production interfaced with parametric programming tools such as Rhino and Grasshopper. Know how to manage the automated production of a timber-frame house wall through the control of CAD / BIM tool parameters.	From examples of architectural projects, highlight the needs of the different stakeholders involved in the development of the construction. Set up a digital model in a collaborative engineering context.	2.75	5.00	
	New programming environments allow production tools such as multi-articulated robots to be managed as desired. They will be implemented on the Kuka KR 210-L-180 Robot.	4.50	7.00	
	The programming parameters of a wall with a view to its automated manufacture are presented. The knowledge will be built through the example of the Woodflex gantry and its gripping aggregate.		4.00	
		7.25	**16.00**	**0.00**

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Part 3: Advanced production **techniques (robotisation)**	**Coefficient 1**
Session leaders: Anis BOUALI, Alain RENAUD	
Teaching assistants: Julien LALLEMAND	
Prerequisites: none	
Teaching materials: Course notes – Presentation slides	
Assessment methods: individual Report	

Learning outcomes	**Description**	**Number of student hours (in-person)**		
		Lectures	**Tutorials**	**Practicals**
Be able to integrate a robot or robotic cell into an existing production environment. Know how to optimise the programming of the robotic tool in order to improve production. ENSTIB's robotic platform will be the preferred medium for this learning.	Awareness of the safety of a robotic cell. Implement the different types of robot controls: manual, semi-automatic and automatic learning. Point-by-point, linear or circular steering.	3.50	10.00	
	Management of program interruptions. Optimisation of cycle times, smoothing of trajectories	3.50	6.00	
		7.00	**16.00**	**0.00**

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Part 4: Optimisation of production processes	**Coefficient 1**
Session leaders: Pierre-Jean MÉAUSOONE	
Teaching assistants: Julien LALLEMAND	
Prerequisites: none	
Teaching materials: Course notes – Presentation slides	
Assessment methods: individual File	

Learning outcomes	**Description**	**Number of student hours (in-person)**		
		Lectures	**Tutorials**	**Practicals**
Improve, control and monitor robotic and NC production processes. Implement advanced control methods and equipment (vision, vibration and acoustics). Analyse manufacturing defects and propose solutions to improve manufacturing processes.	– Set up measuring equipment (power, cutting forces, surface conditions, etc.), – Carry out machining and record values – Analyse production data – Give corrective values	2.75	5.00	
	– Implement control measures – Carry out tests and record values – Analyse data – Characterise applications for the timber industry	2.75	5.00	
	– Apply experience plans for process improvement – Based on an industrial problem encountered, define the influential parameters – Experiment – Determine the optimum setting	1.75	6.00	
		7.25	**16.00**	**0.00**

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