SHORT
ADVANCED
PROGRAMME

REGIONAL UNIVERSITY NETWORK
EUROPEAN UNIVERSITY

DESIGN OF COLD-FORMED STEEL STRUCTURES

11-25.MAY.2022

+INFO: www.run-eu.eu

Organised by: Polytechnic of Leiria
HAMK

PROGRAMME DESCRIPTION/OBJECTIVE

This Short Advanced Programme aims to address the design of cold-formed structures according to the Eurocodes. It focuses on the specific challenges involved, particularly concerning structural principles of stability and failure modes not found in the design of hot-rolled and fabricated steel structures.

Due to their sustainability, the use of Light Steel Framing (LSF) systems is increasingly growing. Today light steel members are used for purlins and other secondary elements in steel construction. The complexity of the design of these structures/members makes this a hugely relevant short course for the industry.

PROPOSED LEARNING OUTCOMES

At the end of this Short Advanced Programme, you will be able to:

- understand the specific issues related to the structural behaviour of cold-formed steel elements
- understand and apply the Eurocode framework to this type of structure
- design cold-formed elements according to the Eurocodes

DATE From **11 to 25 May 2022**
Face-to-Face Week: HAMK, Finland 16-20 May

MODE OF DELIVERY Blended

LANGUAGE OF INSTRUCTION English

ECTS CREDITS 2

ELIGIBLE PARTICIPANTS

RUN-EU bachelor's and master's students
in Civil Engineering and Mechanical Engineering

HOW TO APPLY

Fill in the application form **(QR or website)**

DEADLINE FOR APPLICATIONS

27 April 2022

CONTACT DETAILS

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pedro.gala@ipleiria.pt
zhongcheng.ma@hamk.fi

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SELECTION CRITERIA

Order of submission and academic background

LEARNING AND TEACHING STRATEGY

In-person classes at HAMK

PREREQUISITES

Having studied Strength of Materials or an equivalent discipline, such as the Basis of Steel Structural Design

COURSES LEADERS | LECTURERS

Luis Prola (Polytechnic of Leiria)
Pedro Gala (Polytechnic of Leiria)
Zhongcheng Ma (HAMK)

PHYSICAL MOBILITY | SCHOLARSHIPS AVAILABLE

Travel: €350/person
Subsistence: €400/week

MEANS AND CRITERIA FOR ASSESSMENT

Online work presented by students

CERTIFICATION

Joint Certificate of Participation
Diploma Supplement

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PROGRAMME AT A GLANCE

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	GMT	5h00	6h00	7h00	8h00	9h00	10h00	11h00	12h00	13h00	14h00	15h00
	GMT+3	8h00	9h00	10h00	11h00	12h00	13h00	14h00	15h00	16h00	17h00	18h00
WEDNESDAY 11/5								WELCOME & OPENING SESSION				
MONDAY 16/5				TEAM BUILDING / INTRO TO COLD-FORMED STEEL DESIGN			LUNCH BREAK	BEHAVIOUR AND RESISTANCE OF CROSS-SECTIONS				
TUESDAY 17/5				BEHAVIOUR AND RESISTANCE OF CROSS-SECTIONS			LUNCH BREAK	BEHAVIOUR AND RESISTANCE OF CROSS-SECTIONS				
WEDNESDAY 18/5				BEHAVIOUR AND RESISTANCE OF BAR MEMBERS			LUNCH BREAK	CULTURAL PROGRAMME ACTIVITY				
THURSDAY 19/5				BEHAVIOUR AND RESISTANCE OF BAR MEMBERS			LUNCH BREAK	BEHAVIOUR AND RESISTANCE OF BAR MEMBERS				
FRIDAY 20/5				DIRECT STRENGTH METHOD / COMPUTER-AIDED DESIGN			LUNCH BREAK	COMPUTER-AIDED DESIGN				
WEDNESDAY 25/5								WORK PRESENTATIONS & NETWORKING				

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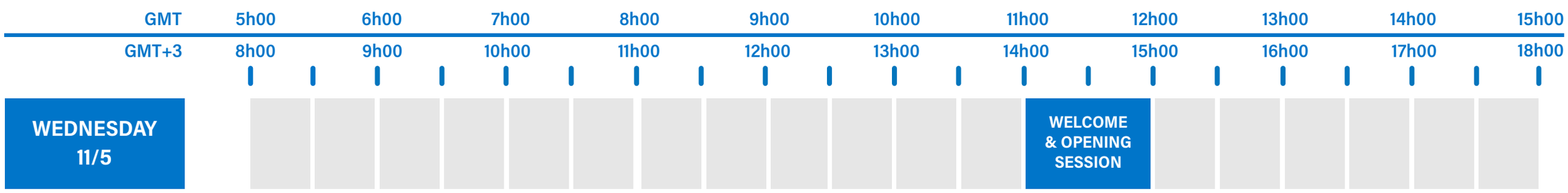
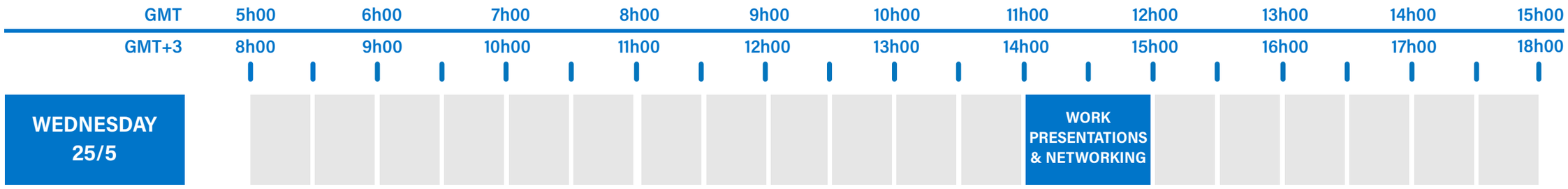
11 MAY | WEDNESDAY 14h00-15h00 GMT+3 · ONLINE



Welcome & Opening Session / SAP Presentation

- 14h00-15h00
- Group Work
- Prof. Luis Prola (Polytechnic of Leiria), Prof. Pedro Gala (Polytechnic of Leiria), Prof. Zhongcheng Ma (HAMK)

25 MAY | WEDNESDAY 14h00-15h00 GMT+3 · ONLINE



Work Presentations / Networking

- 11h00-12h00
- Group Work
- Prof. Luis Prola (Polytechnic of Leiria), Prof. Pedro Gala (Polytechnic of Leiria), Prof. Zhongcheng Ma (HAMK)

Presentations of group work will be given by participants in this session.

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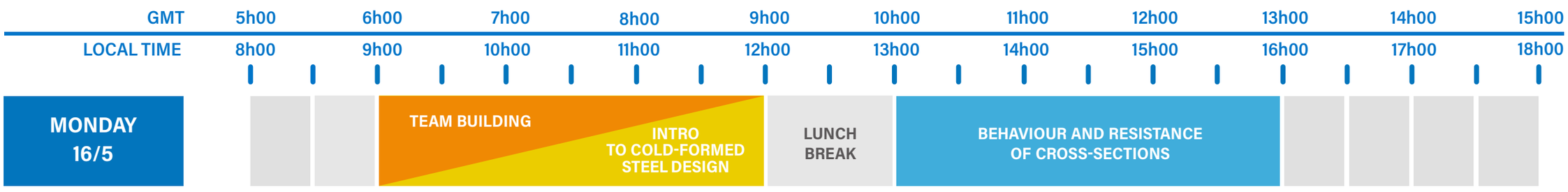
16 MAY | MONDAY 9h00-16h00 · HAMK



Team Building

Introduction to cold-formed steel design

- 9h00-12h00
- Group work
  Lecture
- Prof. Luis Prola (Polytechnic of Leiria)
  Prof. Pedro Gala (Polytechnic of Leiria)

Cold-formed steel system is a sustainable solution for the building industry due to its lightweight and high strength. The general behaviour, versatile section types, manufacturing method and industrial applications will be introduced in this session.

A self-contained overview of the stability of steel elements, namely global, local and distortional phenomena will be taught.

Behaviour and resistance of cross-sections

(Basis of design, local and distortional buckling)

- 13h00-16h00
- Lecture
  Group work
- Prof. Zhongcheng Ma (HAMK)

Due to the thin thickness and large slenderness, the cold-formed steel section is prone to local and distortional buckling under bending or compression loads. Eurocode 3 utilize the 'effective width' concept for local buckling behaviour and 'reduced thickness' for distortional buckling behaviour. Distortional buckling is considered as global flexural buckling of stiffeners in EC3.

This session will present the fundamental behaviour and concept of local and distortional buckling behaviour of cold-formed steel sections and the basis of design according to EN1993-1-3.

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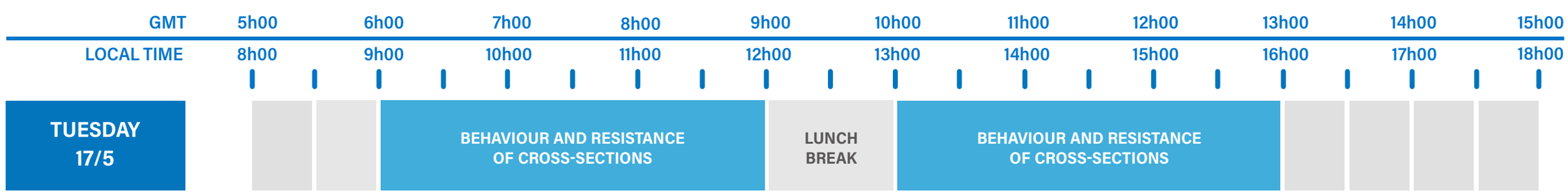

Behaviour and resistance of cross-sections

(Effective cross section)

9h00-12h00
Lecture
Group work
Prof. Zhongcheng Ma (HAMK)

The effective cross section of the cold-formed steel profile is calculated based on the reduced width of plane elements and reduced thickness of stiffeners. After the calculation, the effective properties of cross section, including the effective area and effective section modulus can be determined for compression and bending loads. Design examples will be presented in this session.

Behaviour and resistance of cross-sections

13h00-16h00
Lecture
Group work
Prof. Zhongcheng Ma (HAMK)
Prof. Luis Prola (Polytechnic of Leiria)

With the properties of the effective cross sections being determined, the cross sectional resistance can be readily given according to EC3. The cross sectional resistances include axial tension and compression, bending, and shear.

The combined effect of axial compression and bending stresses will be addressed.

Design examples will be given in this session to show the step-by-step design calculation procedure.

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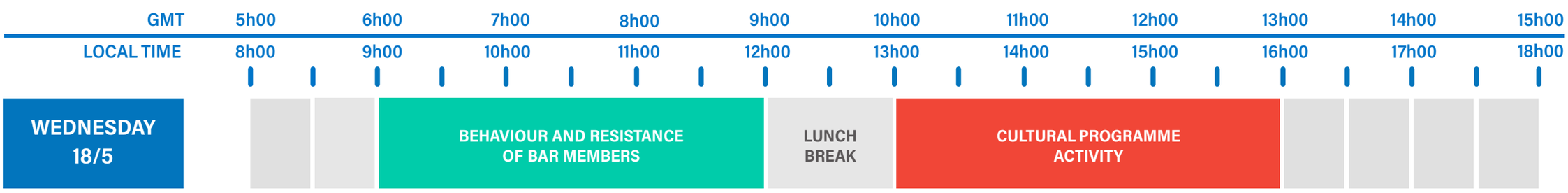
18 MAY | WEDNESDAY 9h00-16h00 · HAMK



Behaviour and resistance of bar members

(Compression members)

- 9h00-12h00
- Lecture
  Group work
- Prof. Zhongcheng Ma (HAMK)

In addition to sectional bucklings (local and distortional), the cold-formed steel studs and purlins may be subject to global buckling modes, such as flexural buckling, torsional and flexural-torsional buckling for compression loads and lateral-torsional buckling for bending moments.

This session will introduce the behaviour and design of cold-formed steel members under compression loads.

Cultural Programme Activity

- 13h00-16h00
- Group work

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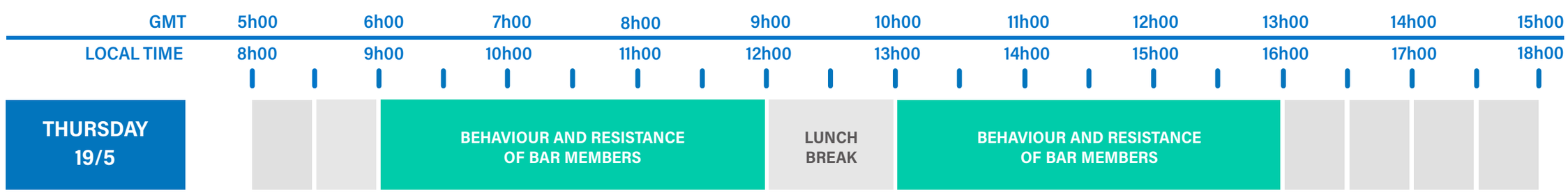
19 MAY | THURSDAY 9h00-16h00 · HAMK



Behaviour and resistance of bar members

(Bending members)

9h00-12h00
Lecture
Group work
Prof. Zhongcheng Ma (HAMK)
Prof. Luis Prola (Polytechnic of Leiria)

This session will introduce the behaviour and design of cold-formed steel members under bending loads.

Afterwards, the combined effect of axial compression and bending stresses will be addressed.

The design examples will be given for steel members under compression and bending loads.

Behaviour and resistance of bar members

(Beams restrained by sheeting)

13h00-16h00
Lecture
Group work
Prof. Zhongcheng Ma (HAMK)

When the purlin beams are subject to bending load, the shear forces in the cross section cause cross-sectional distortion and it must be taken into account in the design. EC3 gives a simplified design method by taking the free flange as laterally restrained by an elastic foundation. The fundamental design concept and procedure will be introduced in this section.

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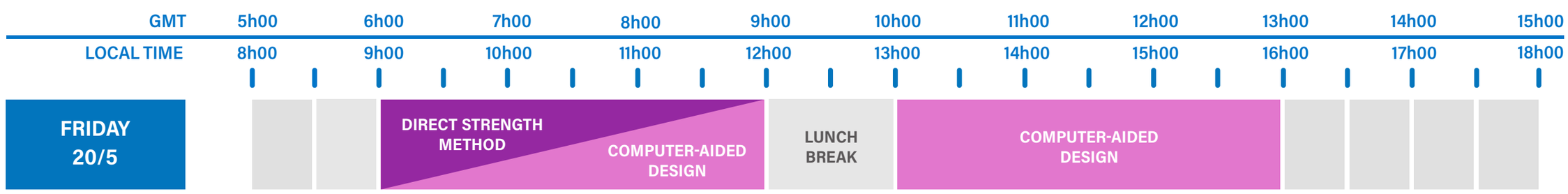

Direct Strength Method
Computer-aided design

- 9h00-12h00
- Lecture
  Group work
- Prof. Luis Prola (Polytechnic of Leiria)
  Prof. Pedro Gala (Polytechnic of Leiria)

A comprehensive overview of the Direct Strength Method (DSM) is present. The DSM is an alternative to the Effective Widths Method, adopted in the AISI and (for example) Australian Code but not in EC3. The main advantage of DSM is its simplicity for practical use. DSM requires however digital tools for computing the critical buckling stresses.

Computer-aided design

- 13h00-16h00
- Lecture
  Group work
- Prof. Luis Prola (Polytechnic of Leiria)
  Prof. Pedro Gala (Polytechnic of Leiria)

Design examples will be presented and solved with the aid of FEM-CAD software, based on the Effective With Method.

Numerical applications software for the computation of critical buckling loads, useful for the DSM, will be presented.

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