MODULE SPECIFICATION

Originating Institution, Department	Module Co-ordinator(s)
Southampton Solent University (SSU)	Assoc. Prof. Sarah Radif, Dr Masoud Sajjadian
VIA University College (VIA UC)	Roger Howard Taylor, ATCM, MCIAT, MAK
Tallinna Tehnikakorgkool (TTK)	Lecturer Pille Hamburg Lecturer Karin Lellep Prof. Martti Kiisa
Vilnius Gediminas Technical University (VILNIUS TECH)	Assoc. Prof. Dr Laura Tupenaite Assoc. Prof. Dr Tomas Gecys Assoc. Prof. Dr Loreta Kanapeckiene Assoc. Prof. Dr Jurga Naimaviciene
Universidade de Lisboa (ULISBOA)	Assoc. Prof. Dr Miguel Amado Arq. Elzbieta Hamadyk

TITLE OF THE MODULE

Title of the module
Sustainable High-Rise Buildings Designed and Constructed in Timber

PROGRAMME(S) IN WHICH TO BE OFFERED

Architectural Design and Technology (SSU)
Architectural Technology and Construction Management (VIA UC)
Architecture (IST)
Civil Engineering (TTK UAS)
Civil Engineering (VGTU)
Construction and Real Estate Management (VGTU)

LEVEL OF STUDIES[1]

First cycle (BSc/BA) ☒	Second cycle (MSc/MA) ☐	Third cycle (PhD) ☐

CREDITS AND LEARNING HOURS

[1] According to the Framework of Qualifications for the European Higher Education Area, Annex 8: http://www.aic.lv/ace/ace_disk/Bologna/Bergen_conf/Reports/EQFreport.pdf

ECTS Value[2]	Indicative academic learning hours[3]	Length (in Semesters)[4]	Year in which to be offered
9	250	1	2

DISTRIBUTION OF LEARNING HOURS

Lectures (25%)	Individual studies (25%)	Project based learning (50%)	Total
62	63	125	250

SUMMARY[5]

Although the design process is fairly similar, the use of timber in high-rise buildings poses a different set of challenges to other materials such as concrete and steel. This module provides an opportunity to explore some of these challenges and assess significant factors affecting the design, production, management and maintenance of high-rise buildings constructed in timber. The module also investigates the inter-relationship between form and function, construction methods, human, social and environmental factors. This includes relevant parts of building regulations and legislation, health and safety, current technical and manufacturers' data.

The module provides vital underpinning knowledge in the construction process, site constraint and superstructure of timber in the context of high-rise buildings. Consideration is given to structural principles and timber systems, e.g. cross-laminated timber, glulam and modular among others. Sustainability, life-cycle assessment, planning and management, and building performance are also explored. Project-based learning enables the application of theory into design and technical solutions that meet client and user requirements.

AIM OF THE MODULE

The module aims to provide students with the opportunity to explore the complex aspects in the design, production and performance of high-rise, timber-framed buildings.

LEARNING AND TEACHING STRATEGIES

In this highly practical module, application of knowledge manifests through problem-based learning using, if possible, real world project briefs, site visits and guest speakers. In studio/workshop sessions students will explore the complex challenges that affect the design, construction and production of high-rise, timber framed buildings. Achievement of the intended learning outcomes is demonstrated through the project outputs. The project allows students to showcase the integration between the design, construction, detailing and management of high-

[2] European Credit Transfer System, 1 ECTS = 25-30 academic learning hours. Please refer to ECTS Users' Guide: https://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf
[3] 1 academic learning hour is equal to 45 minutes
[4] Indicate 0.5, 1, 1.5 or 2
[5] Please provide brief summary of the module, limited to 200 words

rise, timber framed buildings. Students are expected to engage and collaborate with peers who, if possible, are form other built environment disciplines.

Tutors will provide regular briefings to cover specific topics that underpin practical sessions as well as timely, structured feedback. Furthermore, students are expected to demonstrate independent learning through carrying out research and private study. In addition, students should utilise the knowledge and skills gained from other modules thus demonstrate vertical and horizontal attainment of knowledge and skills.

The sessions will offer the opportunity to develop CAD skills using industry standard software such as AutoCAD and Revit. Blended learning, using the Virtual Learning Environment and other digital platforms will also be used to support learning and teaching.

Knowledge and understanding will be demonstrated by appropriate depth of enquiry into the relevant materials and processes. Cognitive skills will be demonstrated by how well the research undertaken is analysed, and how this informs and determines the direction of project work. This will be evident in the range of conceptual ideas explored, problem solving and developmental work. Practical skills will be demonstrated by the ability to realise the final project output through utilising appropriate written, visual and oral presentation techniques.

Real world skills will be demonstrated through the initiative, judgement and contribution to group work. Adherence to deadlines and pacing of work will demonstrate effective project management.

Assessment Strategy:

The primary summative assessment for this module is group project work. Students will be given a brief to design, detail and present solutions for a high-rise, timber-framed building. To demonstrate attainment of the learning outcomes, students are expected to formulate a proposal that considers the context, factors and constraints that affect the design, production and performance of the building. The proposal should demonstrate the integration between design and technology through detailing, and make recommendations for construction methods, building services, cladding systems, etc. In formulating the proposal, students are expected to reference relevant regulatory factors and up to date building products and manufacturers' data. Students must agree the roles and responsibilities of each team member. Each student is required to collaborate and contribute proactively to the group work.

The project will typically be split into three phases:

Phase One - Developed Design: this includes analysing the client brief, carrying out site appraisal, brainstorming, preparing the architectural concept in response to the brief including spatial planning, environmental strategy, elevational treatment, sections and materials. The quality of the drawing package and supporting documentation are expected to meet the minimum standards required to submit the project for approval by the local planning authority.

Phase Two – Technical Design: this stage includes preparing the working drawing package required to obtain statutory approvals in accordance with the local building regulations and legislation. Typically, this should include detailed assembly drawings and production information such as technical details and connections, material specification and performance such as U-values, fire strategy, accessibility and inclusive design, environmental performance, etc.

Phase Three - The final stage of the project is implementation. For this this phase includes preparing a written report to outline the:

- Construction site plan including personal and building site safety, waste management, barracks, storage areas, fencing, temporary electricity and traffic management.
- Erection plan of the timber components including time, machinery, scaffolding, order and delivery of prefabricated elements, temporary support etc.
- Detailed time schedule for the construction of the timber parts;
- Quality control during erecting the timber structures paying special attention to moisture.

The length of the report should be approximately 2000 word plus supporting evidence, sketches, etc. The report must be structured, presented and referenced using academic best practice. It must be clear, concise, focussed and backed up by evidence.

Formative assessment will be used to provide students with feedback at set intervals. The formative assessment will be carried out through interim, informal submissions which will be set out in assessment brief.

INTENDED LEARNING OUTCOMES AND ASSESSMENT

Learning Outcomes of the module[6]	***Methods of study***	***Assessment Criteria***	***Assessment methods of student achievements[7]***	***Achievement level indicators***
Research and analyse the factors affecting the design, construction and detailing of high-rise timber framed buildings.	Lectures Workshops/Studios Problem-based learning Blended Learning	Depth of enquiry into the relevant materials and processes in the context of the design, construction and detailing of high-rise timber framed buildings	☒ Problem solving questions ☐ E-tests ☐ Regular tests ☒ Problem solving tasks ☒ Projects ☒ Peer evaluation ☐ Automated feedback	***Threshold:*** Limited depth of enquiry into the relevant materials and processes in the context of the design, construction and detailing of high-rise timber framed buildings.

[6] Learning outcomes are specified in three categories – as **knowledge, skills and competence**. This signals that qualifications – in different combinations – capture a broad scope of learning outcomes, including theoretical knowledge, practical and technical skills, and social competences where the ability to work with others will be crucial. Please refer to Cedefop (2017). Defining, writing and applying learning outcomes: a European handbook. Luxembourg: Publications Office of the European Union. https://www.cedefop.europa.eu/files/4156_en.pdf.

[7] Please select from the list. Additional assessment methods may be added.

			☒ Final evaluation ☐ Other:	***Typical:*** Satisfactory depth of enquiry into the relevant materials and processes in the context of the design, construction and detailing of high-rise timber framed buildings.
				Excellent: Exceptional depth of enquiry into the relevant materials and processes in the context of the design, construction and detailing of high-rise timber framed buildings.
Establish client requirements, preferences and priorities in order to formulate technical solutions to problems of unfamiliar context	Lectures Workshops/Studios Problem-based learning Blended Learning	Synthesis and analysis of research undertaken, and how this informs and determines the direction of project work	☒ Problem solving questions ☐ E-tests ☐ Regular tests ☒ Problem solving tasks ☒ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final evaluation ☐ Other:	***Threshold:*** Limited synthesis and analysis of research undertaken
				Typical: Satisfactory synthesis and analysis of research undertaken to inform and determine the direction of project work
				Excellent: Robust synthesis and analysis of research undertaken to inform and determine the direction of project work
Formulate a solution that responds to the functional, technical and regulatory factors affecting the design, production and performance of multi-store buildings	Lectures Workshops/Studios Problem-based learning Blended Learning	Accuracy of the response presented by the design proposal to client requirements, functional, technical and regulatory factors affecting the design and construction of high-rise timber framed buildings	☒ Problem solving questions ☐ E-tests ☐ Regular tests ☒ Problem solving tasks ☒ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final evaluation ☐ Other:	***Threshold:*** Limited response of design proposal to client requirements. Functional, technical and regulatory factors affecting the design and construction of high-rise timber framed buildings are superficially addressed
				Typical: Satisfactory response of design proposal to client requirements. Functional, technical and regulatory factors affecting the design

				and construction of high-rise timber framed buildings are accurately addressed
				Excellent: Innovative response of design proposal to client requirements. Functional, technical and regulatory factors affecting the design and construction of high-rise timber framed buildings are accurately addressed and to an advanced level
Communicate design solutions with confidence using a range of media and visual communication tools	Lectures Workshops/Studios Problem-based learning Blended Learning	Ability to realise the final project outputs using appropriate written, visual and oral presentation techniques	☒ Problem solving questions ☐ E-tests ☐ Regular tests ☒ Problem solving tasks ☒ Projects ☒ Peer evaluation ☐ Automated feedback ☐ Final evaluation ☐ Other:	***Threshold:*** Ability to realise the final project outputs using a limited range of written, visual and oral presentation techniques
				Typical: Ability to realise the final project output using above average written, visual and oral presentation techniques to a good standard
				Excellent: Ability to realise the final project output using innovative written, visual and oral presentation techniques and to a professional standard
Application of real-world skills in the project context	Lectures Workshops/Studios Problem-based learning Blended Learning	Use of initiative, judgement, contribution to group work, adherence to deadlines and effective project management.	☒ Problem solving questions ☐ E-tests ☐ Regular tests ☐ Problem solving tasks ☒ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final evaluation ☐ Other:	***Threshold:*** Limited use of initiative, judgement, contribution to group work, adherence to deadlines and effective project management.
				Typical: Reasonable use of initiative, judgement, contribution to group work, adherence to deadlines and effective project management.
				Excellent:

				Excellent use of initiative, judgement, contribution to group work, adherence to deadlines and effective project management.

ASSESSMENT [8]:

Assessment components (in chronological order of submission/examination date)				
Type of assessment[9]	Weighting, %	Duration *(if exam)*	Word count *(if essay or similar):*	Component pass required[10]
Interim assessment 1	20%	20 minutes presentation	NA	Yes ☒ No ☐
Interim assessment 2	20%	20 minutes presentation	NA	Yes ☒ No ☐
Final assessment	60%	30 minute Presentation	NA	Yes ☒ No ☐
Total:	100%			

LECTURE TOPICS

No.	Topic[11]	Number of hours
1.	Introduction - History of high- rise buildings	2
2.	Timber: origin, materials, methods and systems	2
3.	Timber as construction resource and material	4
4.	Architectural design and sustainability of high-rise timber framed buildings	4
5.	Use of BIM in modelling of high-rise timber framed buildings	6
6.	Structural design of high-rise timber framed buildings	2
7.	Engineered timber systems	6
8.	Environmental impacts of high-rise timber framed buildings	4
9.	Moisture performance of high-rise timber framed buildings	4
10.	Fire safety and protection of high-rise timber framed buildings	4
11.	Acoustics and noise abatements high-rise timber framed buildings	4
12.	Design of service systems high-rise timber framed buildings	4
13.	Construction process (site) management	6
14.	Quality control in the construction of high-rise timber framed buildings	6
15.	Maintenance and repairs of high-rise timber framed buildings	4
	Total:	62

[8] Please list all components, sum must be equal to 100%. Note that successful course completion should be recognised as indicating worthwhile educational achievement.
[9] Please indicate in chronological order of submission date each assessment component by type, e.g. examination, home work, coursework, project
[10] Indicate Yes to specify the assessment component(s) to be passed in order to pass the module
[11] Please add as many topics as needed

TASKS FOR PROJECT-BASED LEARNING

No.	Task[12]	Number of hours
1.	Brief phase: analysis of requirements for the project by the Client or Client advisors, precedence analysis	5
2.	Sustainability considerations	10
3.	Concept design with plans, sections, elevations and 3D illustrations	20
4.	Technical design including compliance with building regulations, fire strategy, compliance with accessibility requirements and	20
5.	Programme of works, costings, life cycle analysis, site management, health and safety requirements	20
6.	Scheme proposal	20
7.	Working drawings	25
8.	Presentation of final project in PowerPoint format	10
	Total:	**125**

LEARNING MATERIALS[13]

Core materials (up to 5 references):

1. Sustainable High- Rise buildings designed and constructed in timber
2. Handbook “Design, Construction and Management of Wooden Public Buildings”. Pub-Wood, 2020.
3. Kaufmann, H., Krötsch, S., and Winter, S. (2018). Manual of Multistorey Timber Construction. München: DETAIL.
4. Forest Products Laboratory, Wood Handbook, Wood as an Engineering Material, Madison, WI: USDA 2010.
5. McLeod, V. (2015). Detail in Contemporary Timber Architecture, London, Laurence King Publishing.
6. Green, M.,Taggart, J. (2017). Tall Wood Buildings: Design, Construction and Performance. Birkhauser
7. EN 1995 Eurocode 5: Design of timber structures

1. **Supplementary materials (up to 10 references):**

2. Asdrubali, F., Ferracuti, B., Lombardi, L., Guattari, C., Evangelisti, L., and Grazieschi, G. A review of structural, thermo-physical, acoustical, and environmental properties of wooden materials for building applications. Build. Environ., vol. 114, pp. 307–332
3. Barber D., and Gerard, R. High-Rise Timber Buildings – SFPE. Fire Protection Engineering, no. Quarter 3

[12] Please add as many tasks as needed

[13] Courses should provide high quality materials to enable an independent learner to progress through self-study. Materials should make best use of online affordances as well as rich media (video and audio) to engage students with their learning.

4. Cuadrado, J., Zubizarreta, M., Pelaz, B., and Marcos, I. Methodology to assess the environmental sustainability of timber structures. Constr. Build. Mater., vol. 86, pp. 149–158
5. Breyer, D., Cobeen, K., Fridley, K., & Pollock, F. (2014). Design of Wood Structures-ASD/LRFD (7th ed.). McGraw-Hill Education.
6. Dodoo, A., Gustavsson, L., and Sathre, R. Lifecycle primary energy analysis of low-energy timber building systems for multi-storey residential buildings. Energy Build., vol. 81, pp. 84–97
7. Hugues, T., Steiger, L., & Weber, J. (2004). Timber Construction. BIRKHÄUSER.
8. Lennartz, M. W., & Jacob-Freitag, S. (2015). New Architecture in Wood. BIRKHÄUSER.
9. Mayo, J. (2015). Solid Wood: Case Studies in Mass Timber Architecture, Technology and Design. Routledge.
10. Ramage M. H. et al., The wood from the trees: The use of timber in construction. Renew. Sustain. Energy Rev., vol. 68, pp. 333–359
11. Sabnis, A., Mysore, P., and Anant, S. (2015). Construction Materials-Embodied Energy Footprint-Global Warming. Interaction.
12. Zaya, A. F., & Diener, T. (2017). Heavy Timber Structures: Creating Comfort in Public Spaces. Schiffer.

On-line resources:

Available at Moodle environment:
https://fenix.tecnico.ulisboa.pt/cursos/ma
https://www.storaenso.com/-/media/Documents/Download-center/Documents/Product-brochures/Wood-products/Design-Manual-A4-Modular-element-buildings20161227finalversion-40EN.ashx
https://issuu.com/storaenso/docs/stora_enso_clt_-_technical_brochure
https://www.trada.co.uk/publications/

Other materials:

REQUIRED IT RESOURCES[14]

No.	Software, manufacturer
1.	MS Word
2.	MS Excel
3.	MS Power Point
4.	Adobe Acrobat reader
5.	Revit/ArchiCad/AutoCad
6.	Finite element software Dlubal Rfem/Robot Millennium

[14] Please add as many software as needed for the course

Date of completion of this version of Module Specification 01/07/2020