

Description and Syllabus of the international, modular Wood Building & Construction Course

**Project Part IV:
Observation and entering of new markets through the establishment of an
advisor network as well as the development of a modular Wood Building
Course**

“Development of a modular Wood Building & Construction Course”

**Advance the Carpenter and Wood Building Centre Kassel to a Centre of
Competence for the Joiner and Wood Construction/Building Trade**

Introduction

Over the last years, wood has undergone a dramatic transformation internationally through the latest developments in wood building materials and the use of prefabricated modules as well as the change in the general value system for building materials and is now seen as an almost new class of building material. For the processes of an efficient production that is reaching excellent and consistent quality through the use of the most beneficial materials and under consideration of economical principals it is essential to have scientifically defined properties and consistent performance of the material. For a long time the natural, renewable construction material wood could not fulfill these requirements. Today, industrially produced, high quality wood products are available for the use in the building industry and fulfill a variety of construction requirements.

In addition to the technological change, the importance of wood building and construction has increased due to the ecological considerations of the population. The use of wood is CO₂-neutral and therefore, doesn't increase the Carbon dioxide concentration in the atmosphere and offers an advantage in comparison to fossil raw materials. Wood is not very heavy, the transport distances are short and processing is easy which leads to a very energy efficient production of wood components in comparison to other raw materials. The ecological assessment of pre-fabricated wooden homes shows that the required energy use for a 100 square meter apartment is only two thirds of the energy use of a conventional building. Those positive effects on climate and environmental protection increase the acceptance wood as a building material.

Besides the market for new homes the role of wood has become more important for modernization and renovation projects as for those projects wood cannot only be used as a construction material for the actual building but also has other applications during construction. Wood blends easily in with the existing building from an esthetical as well as constructive viewpoint. Wood components are also easier to repair and if needed can be accessed easily in an existing building for purposes of modernization, renovation as well as repair work which make wood as a building material very attractive.

Surveys of wood building companies in Germany show that this industry sector is in a phase of restructuring. The introduction of capital intensive, partially automated production systems is replacing the manual labour in mid-sized wood building companies with industrial production methods that increasingly utilize pre-fabricated components.

Increased volume and flexibility of the production system however, increases the functional complexity. To successfully undergo this restructuring process, the companies require qualified staff especially in the areas of leadership, investment planning, project management, product management, work flow planning and organization.

These developments take place in the setting of high standards of technology in the wood building sector in Germany. Based on the assumption that the developments are transferrable to other countries, the traditional high quality of the basic and continuing education in the German wood building sector gains special importance. The interest in international technology transfer will increase.

This modular wood building course is intended to put education standards of modern wood construction internationally into place.

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1. Assumptions and Environmental Analysis

The project to develop a course for wood building and construction with a strong focus on practical application is based on the demographic development of Western industrialized nations which will cause substantial changes in the age pyramid of the working population. The German and international wood building sector requires well trained and motivated employees to secure the future of the companies. To be able to compete for young leaders and managers, the wood building sector has to create an open path for advancement which builds on various competencies and prior qualification levels. Education and knowledge are important factors in the dynamic development of the wood product and building sector and necessary to be able to compete in the market.

The current requirements have changed and added to the day-to-day challenges presented to managers and employees in the wood building industry. This includes changes in the production, the management of the company as well as technological developments especially in the areas of materials science, construction, statics and physics. An important part of the education is the use of computer programs.

Focus on practical application of the course content in the areas of management, technology and sustainability are important in the layout of the modular international wood building course. The participants of the course will gain sound theoretical and practical knowledge and skills which will be applied in the wood building sector.

This wood building course and the exams are intended to enable the participants to lead a wood building company, manage planning, production and business administration as well as independently use competencies to adjust those areas as needed for new requirements.

The course layout is modular which places the focus on comprehensive qualification instead of individual subject knowledge and skills. Projects, exercises and discussions are methods of this modern qualification, which is focussed on a strong customer orientation in the same way the education sector of the future is.

The carpenter and wood building centre Kassel has excellent connections to associations and companies and which offers direct access to the decision makers in those companies. This modular, international course was developed in close cooperation with the companies and associations and is based on the requirements of the wood building sector.

2. Details about the structure of the course

The course offers the participant the opportunity to structure the future qualifications under consideration of future professional goals as well as existing qualifications.

The course is mainly aligned to the various needs of the German wood building and construction industry but also considers international developments. With regard to the expected dynamic development around the raw material and building component wood the demand for well trained, internationally oriented experts and management personnel will increase.

The participants of the international wood building course with professional experience will obtain competencies which allow them to support the management of national and international operating companies and to solve hands-on challenges in various administrative and technical areas or to start their own business.

The international wood building course is based on three pillars. The first pillar is a sound practical understanding and training. The foremost content for this pillar is the planning and completion of wooden structures and buildings. Building on the adjustment of existing knowledge in subjects of natural science detailed knowledge of the specific subjects of wood building construction and renovation will be imparted. The third pillar consists of gaining fundamental and application oriented knowledge in the areas of business administration and order processing.

The course content is presented in modules and is partially offered bi-lingually (German/English). The theoretical and practical teaching contents are aligned with the requirements of day-to-day business. The modules are individual units of content that cover a certain area of knowledge in a specified period and that will be finalized with an exam. Modules can contain various teaching objectives and may be based on different pedagogic or didactic methods.

The wood building course consists of four modules. Each of those four modules covers one subject area. The structure of the modules aims to impart practical and technical knowledge first including jointing methods, machine technology, building physics, materials science, and after that the business administration aspects will be covered. At the end of each subject matter, an exam is conducted. Those are the precondition for the different qualification levels "Holzbaufachkraft", "Holzbauvorarbeiter", "Holzbauprofi" and combined become the final qualification of "Holzbau-Meister".

The course layout builds on the different competencies gained through professional experience and the knowledge and skills of professional education. The layout is aligned with the day-to-day practical requirements and based on that determines areas of teaching with goals and teaching contents. This structure is meant to show the comprehensiveness of professional learning, to boost cooperative ways of learning, build and expand methodical and social competencies as well as support innovative ways of teaching. The coordination of the various teaching areas is meant to support cross-curricular and team oriented work.

The course layout points towards the intensity of the various contents and teaching areas by assigning an appropriate number of hours.

The possibility to use computer processing can be taken advantage of during the prep classes as well as Part I and Part II.

Contingent on the required entry qualifications practical knowledge in the area of wood processing or wood construction is necessary.

In addition, applicants should not only possess the key competencies of learning aptitude and willingness to perform but also have an interest in mathematical and natural science topics.

The current version is mainly based on the definition of the modular concept of an international, modular wood construction course. In addition to the professional qualifications in Germany, North American and Canadian educational standards and developments have been taken into consideration.

Based on this modular system, further adjustments and additions can be made in accordance with other international partner's requirements until a firmly defined course layout has been established.

Based on the determined competencies formed by requirements and qualifications of the participants Germany already has a detailed syllabus, which however is not part of this concept and has the following structure:



The descriptions of the learning objectives are integrated into 4 levels of taxonomy: Knowledge (insight, overview, proficiency, familiarity) – competency (ability, skill, mastery) – identification (awareness, comprehension, understanding) – values. Those didactic key aspects are structured into further requirement levels (in parenthesis).

The link between competencies and learning objectives is shown in the time table framework (short version of the syllabus) for the presented concept. In the detailed course layout the various learning objectives can be selected from the time table frame work and defined through learning tasks including content. During this process, the specific professional qualifications of the participants of involved international partners need to be considered and therefore, intensive coordination is necessary.

3. Exam Structure

The different modules of the international wood building course are finalized with various exams.

Exams in the practical aspects of the course include the following for the completion of proof of competency:

- A planning project that focuses on a customer order
- A detailed conversation about the project
- Two practical tasks resulting from the customer order

The participant has to create planning documentation for a wood structure based on a customer order. Main tasks of the planning project are

1. Creation of plans and drafts
2. Design of corresponding detailed drawings and blueprints.

Based on the accomplishment in the planning project a discussion is conducted. The course participant is required to demonstrate the correlations of the project. The candidate has to explain the process and the encountered problems as well as demonstrate the proposed solutions and be able to consider new developments.

The practical assignment of the exam consists of two exercises selected from the following three areas: wooden joints, connections, and defects, damage and deficiency detection.

The theoretical exam areas are aligned to the main focus areas of a wood building company. The exam covers the following three areas:

- Structural engineering
- process planning, inventory control, building materials
- Order processing and business organization

For each of the exam areas at least one exercise has to be completed. The exams are conducted in writing. The exercises are structured in a way that connects several competencies of the different teaching areas and therefore show a comprehensive picture of the necessary qualifications of the wooden building industry.

4. Linking of individual qualification levels

The modular structured continuing education integrates the qualification levels “Holzbaufachkraft, Holzbauvorarbeiter, Holzbauprofi und Holzbau-Meister”. This allows the participants to schedule modules based on interest, time frame, or classes offered. The modules can be completed individually or in sequence. Once a certain portion of the modules has been completed, the exam for the next qualification levels can be taken. This requires learning tasks that are coordinated and build upon each other.

The table below shows the modular structure of the advanced training from a trained carpenter to the supervisor and final “master” level and the required exams as well as the overall course layout:

	Modul-No.	Hours	Content	Exams						
Internationaler Holzbau-Meister										
International „Holzbau-Meister“	1	200	Practical Term: Practical assignment (160 hours): <ul style="list-style-type: none"> • Wooden joints • Connections • Machine technology Theory: Learning objective 1: Structural Engineering (40 hours)	Exam: Practical term: First order oriented assignment						
	2				190	Practical Term: Practical assignment (50 hours): <ul style="list-style-type: none"> • Wooden joints • Defects and deviciency detection Theory: Learning Objective1: Structural Engineering (40 hours) Learning Objective 2: Process Planning, Inventory Control and Materials Science (100 hours)	Exam: Practical Term: Second order oriented assignment Theory: Learning Objective: Process Planning, Inventory Control and Materials Science			
	3							200	Theory: Learning Objective1: Structural Engineering (80 hours) Learning Objective 3: Order processing and business organization (120 hours):	Exam: Theory: Learning Objective: Order processing and business organization
	4									
Total	900									

The assignment of individual learning objectives to various modules in the syllabus is shown in the header of the table.

5. Timetable (short version)

5.1 Practical training

Planning Project

Competencies	Goal definition (learning tasks)	Number of lesson hours (45 Min.)	Module
1) Create planning and draft documentation	1. Preliminary considerations and space allocation design	4	4
	2. Obtain required documents and give the concept preliminary consideration	2	4
	3. Design a wooden structure based on a specified framework	20	4
	4. Create the required calculations and description	4	4
	When completing the assignment above the knowledge gained during the theoretical lessons have to be taken into consideration. The listed number of hours for the course however, cover only the completion of a defined project.		
2) Create detail and shop drawings for roof-, ceiling-, trusses and wall construction and siding	1. Create shop drawings for wooden buildings.	24	4
	2. Create detail drawings of the designed structure.	16	4
Total Hours Planning Project:		70	4 (70)

Practical Assignment

Competencies	Goal Definition (learning tasks)	Number of Lesson Hours (45 Min.)	Module	
1) Scribe and produce a wooden joint as per the provided drawing	1. Hand tools and usage	4	1	
	2. Wooden joints in traditional timber frame construction	24	1	
2) Based on a provided drawing mark, join and assemble beams	1. Connections, joints and profiles of beams for various timber frames	12	1	
3) Based on a provided drawing of a roof construction calculate, scribe, mark and place beams	1. Manually or by using the PC centre beams from the roof structure, create the connections and transfer information to the drawing board, then scribe the corresponding beams	80	1	2
	2. Calculate the connection measurements for the placement of the beams (refer to HF 1a)	12	1	2
	3. Create drawings for the beams for the roof structure on the drawing board and scribe the corresponding beams.	12	1	
4) Detect defects, damages or deficiencies of a wooden construction based on the pre-assembly drawing with a focus on quality, production time, material used, and work organization; document observation and present solutions	1. Use provided planning documentation (pre-assembly drawing, manually or computer based) to detect errors, analyse and evaluate the information	22	1	2
	2. Develop solutions under consideration of building inspection and structural engineering rules.	20	1	2
5) Safe handling of wood processing machinery	1. Stationary wood processing equipment	12	1	
	2. Hand tools	12	1	
Total Hours Practical Assignments:		210	1 (160)	2 (50)

5.2 Vocational Studies

Exam Topic 1: Structural Engineering (ET1 = 400 Hours)

Competencies	Contents (learning tasks)	Number of lesson hours (45 Min.)	Module	
a) Design and plan a wooden structure considering requirements of construction physics and static rules	1. Basic principles of structural engineering	20	3	4
	2. Basic principles of structural analysis	14	4	
	3. Bearing consideration in "above ground" structural engineering	4	4	
	4. Traditional timber framing static	8	4	
	5. Proof of stability	18	3	4
	6. Weaknesses of cross section stability	4	4	
	7. Stability consideration in wooden construction	4	4	
	8. Stiffness of building envelopes	8	4	
	9. Construction designs of roofs (bearing considerations)	16	3	4
	10. Different types of ceiling constructions	8	3	4
	11. Traditional timber frame construction	8	4	
	12. Timber frame construction	6	4	
	13. Wood frame and panel construction	16	3	4
	14. Log home construction	6	4	
	15. Cantilever construction	8	4	
	16. Wall and ceiling construction (including support structure)	4	4	
	17. Transport and assembly when loaded	4	4	
	18. Centre the roof layout	20	2	3
	19. Calculation of beam layout	20	1	2
b) Plan connections, joints and braces for wood structures	1. Connection points with mechanical connectors	18	3	4
	2. Carpenter made joints	12	3	4
	3. Connectors of braces and reinforcements	8	4	
	4. Connectors to solid wood components	6	4	
	5. Connectors of roof structures	6	4	

Competencies	Contents (learning tasks)	Number of lesson hours (45 Min.)	Module			
c) Design and plan a wooden staircase	1. Terms and engineering standards	4	1			
	2. Various kinds and styles of stairs	12	1			
	3. Material requirements	6	2			
	4. Surface treatment and coating	4	2			
	5. Design and construction, defects	20	1	2		
d) Calculate and evaluate building components and building structures in consideration of engineering regulations for cold and heat insulation, moisture, sound, and fire protection. Complete your findings with proposed solutions.	1. Basic principles of heat insulation - Basic terms; heat transmission; thermal bridges	38	3	4		
	2. Basic principles of moisture protection - Basic terms; moisture transmission; calculation methods; causes, results and prevention of condensation buildup	12	3	4		
	3. Basic principles of sound protection - Basic terms; sound protection requirements; impact and airborne sound; training	12	3	4		
	4. Basic principles of fire protection - Basic terms; building material classification and fire resistance grading; - Fire behaviour of building materials and elements; requirements and testing - Fire protection structures	12	3	4		
e) Evaluate constructions with regard to airtightness, select a measuring method and substantiate the selection.	1. Terms and rules around airtightness	4	4			
	2. Measuring methods and evaluation of results	4	4			
	3. Typical leaks	6	4			
	4. Concepts of airtightness and details for completion	6	4			
f) Assembly of prefabricated components and elements as well as planning of energy collectors and energy converters for roofs and walls.	1. Solar energy systems	8	4			
	2. Photovoltaic installations	6	4			
Total hours for exam topic 1: Structural Engineering		400	1	2	3	4

Exam topic 2: Process planning, inventory control, building materials (ET2 = 100 hours)

Competencies	Contents (learning tasks)	Number of lesson hours (45 Min.)	Module
a) Evaluate various kinds and characteristics of building materials and allocate those to the appropriate application	1. General properties/basic terms	14	2
	2. Branding of materials	4	2
	3. Resins and mineral bound as well as other engineered wood products	2	2
	4. Panel products used for dry wall construction	2	2
	5. Insulation materials	4	2
	6. Foils and sealants	2	2
	7. Building materials for solid construction	4	2
	8. Metals, plastics and various types of glass	4	2
	9. Fasteners and accessories	2	2
	10. Paint finish and coating	2	2
	11. Corrosion prevention	2	2
	12. Glued connections	2	2
b) Describe problems in the area of delivery control, storage, transport and processing of materials, develop solutions, evaluate and correct.	1. Quality control of received goods (e.g. measuring of moisture content, sorting criteria)	4	2
	2. Surface treatment of wood	4	2
c) Plan and evaluate chemical wood protection measures; describe options of proper kiln dry as well as their use and importance.	1. Wood pests (animals)	6	2
	2. Wood pests (plants)	6	2
	3. Preventative chemical wood protection	4	2
	4. Chemical treatments (wood pests); treatment options	2	2

Competencies	Contents (learning tasks)	Number of lesson hours (45 Min.)	Module
d) Plan and evaluate constructive wood protection measures for building elements and structures.	1. Structural wood protection.	12	2
e) Calculate volume and material for a construction site including logistical considerations.	1. Wood- and material lists.	6	2
	2. Various types of wastage and loss as a result of processing	2	2
f) Plan and evaluate the use of different types of scaffolds.	1. Supporting scaffold	4	2
	2. Scaffold (general)	4	2
	3. Safety scaffold	2	2
	Total hours exam topic 2: Process planning, inventory control, building materials	100	2 (100)

Exam topic 3: Order processing and business organization (ET3 = 120 hours)

Competencies	Contents (learning tasks)	Number of lesson hours (45 Min.)	Module
a) Prepare the documentation for quotes and evaluate proposals, calculate quotes.	1. Description of services	8	3
	2. Create a quote	16	3
	3. Calculation of a building contract, calculation types and methods	4	3
	4. Pricing	2	3
b) Evaluate methods and procedures of process planning and business organization under consideration of production and maintenance processes, position measuring and levelling and assignment of materials, equipment and staff and their interfaces	1. Position measuring	4	3
	2. Leveling	4	3
	3. Scheduling (establish plans for construction times)	6	3
	4. Capacity planning (materials, staff, equipment)	4	3
	5. Construction phases	2	3
	6. Planning of plant layout and equipment	4	3
c) Create, evaluate and correct plans, drafts, technical drawings, assembly guidelines as well as construction site reports.	1. Reporting	2	3
	2. Assembly and standard operating procedure	4	3
d) Calculate work performed, provide pre- and post calculation as well as invoicing based on contractual terms.	1. Final costing and efficiency control	4	3
	2. Invoicing	4	3

Competencies	Contents (learning tasks)	Number of lesson hours (45 Min.)	Module
e) Establish costs and expenses considering business organization and management.	1. Basic principles of profit loss accounts	4	3
	2. Overhead or indirect cost calculation (cost centre accounting)	4	3
	3. Determination of overhead rates	6	3
	4. Types of costs	8	3
f) Evaluate corporate cost structure; establish management ratios (key data)	1. Key performance indicators	4	3
	2. Controlling	6	3
	3. Cost efficiency analysis	4	3
g) Develop company specific measures to ensure guidelines of occupational health and safety as well as environmental protection laws are adhered to; provide risk assessments and develop measures to avoid and remove risks.	1. Occupational health and safety	4	3
	2. Safety engineering	4	3
	3. Handling of hazardous materials	2	3
	4. Risk Assessments	4	3
	5. Environmental protection laws	2	3
Total hours exam topic 3: Order processing and business organization		120	3 (120)