

Timber Industry Engineer MSc.

List of curriculum

Basic science classes

Applied mathematics

Contents: problems leading to differential equations and their solutions in mathematics, chemistry, physics, mechanics, chemistry, biology, etc. Vector-vector functions. Derivate tensor, divergence, rotation and their applications. Nonlinear equations and their numerical solutions. Extremal problems. Conditional extremum. Integral calculus and its applications (in one and several variables). Fundamentals of crystal geometry.

Wood chemistry

While considering the different fields of wood technology sooner or later one will have to come across various chemical issues. The right way of dealing with wood adhesives, surface treatment, wood color, finishing, steaming etc. requires essential knowledge about the chemical composition and characteristics of the wood. The aim of the subject is to provide a general, but also broad view of the chemistry of wood. The topics include: the (macro)molecular composition and structure of wood; the distribution, role and utilization of substances; wood degradation – effects and products; the surface of wood: properties and their modification; the color of wood; calorimetric properties of wood; wood as a resource of chemicals and natural products. The lectures combined with the laboratory work provide a solid knowledge in the field of wood chemistry. The theoretical and practical skills can be applied in various fields of wood technology and research.

Physics for engineers

Electric state, electric field, motion of charged particle in electric field. Gauss law and its applications. Electrostatics properties of conductors. Electric potential, capacity, current, resistance. Kirchhoff's laws. Magnetic field, Biot-Savart, Ampère, Faraday and Lenz laws. Alternating current, power. Geometric and physics optics. Black body radiation, photoelectric effect. Structures of atoms, molecules and solid-states. Elements of nuclear and particle physics.

Dynamics

Kinematics: Fundamental notions of kinematics. The kinematics of the point: motion function, velocity function, acceleration function. Basic tasks, diagrams of kinematics. Special motions of the point: motion along a straight line, in a plane, in the space. Kinematics of the solid body: the state of motion, state of velocity, state of acceleration of the solid body; elementar motions, finite motions. Kinematics of constructions: degree of freedom of mechanisms, definition of the motion characteristics. Kinematical investigation of simple mechanisms: crank mechanism, link motion, four-member hinge mechanism, six-part link mechanism, intermittent drivers. Kinematics of the relative motion. Kinetics: Fundamental notions of kinetics. Kinetics of the materialized point: basic law of kinetics, theorems and principles of the materialized point, some special motions of materialized point: free motion, forced motion. Kinetics of relative motion. Kinetics of the solid body: forces acting on the rigid body and their groups: inertia moment of the rigid body, and the connected theorems, basic equations of the motion of rigid body, special motions of the rigid body: linear movement, rotary motion, planar motion, harmonic oscillation, generated and damped oscillation, critical revolution number, forced motions, the physical pendulum, critical

revolution number of axes, torsional vibrations. Kinetics of constructions: determination of forces acting on the construction parts, impact processes.

Electronics

Lectures: The students learn the principle of the modern semiconductor devices (diodes, bipolar and field effect transistors, etc.), the working of the basic analogous (amplifiers, oscillators, multivibrators, etc.) and digital (gates, registers, counters, microprocessors, analogous-digital and digital-analogous converters, etc.) electrical circuits and their application in the measuring technique. Practices: The students get acquainted with the principle of the different electrical instruments (power supplies, voltmeters, generators, oscilloscopes, etc.) end with their practical applications. During the measurements they can see the working of the main electrical devices and circuits learned during the lectures.

Finance

An overview about the institutions and the classification of aims and devices of the fiscal system. A brief introduction of the main idea and the development of the gold specie-system. A thorough analysis of the credit money-automatism. The main types of securities and their characteristics. The bank- and credit system. The stock exchange and its operation. The devices and options of the money- and securities market. An overview about the devices of the state finance system and the fiscal policy. The characteristics of the foreign exchange administration and the foreign exchange policy dissolving the restriction of a closed economy. The determinant factors of the money turnover and the requirements of its regulations.

Management

Nowadays it is essential to learn management, leadership and organization, because students have to know the ways of being a main member of an organization. They have to have the knowledge of making a venture, the legal parts and the possibilities. In this subject they can find out the new leadership methods in the permanently changing business world. In the term of the subject they have trainings about the topic (see below). Without up-to-date strategically thoughts no one and no organization can stay for a long time in the business markets. Human Relationship Management. The Japanese Management. The inside and outside factors of the formation of organizations. The structures of organizations I. (linear, linear-functional). The structures of organizations II. (divisional, matrix). The model of organizational attitude. The group dynamics. Making a group. The relationships between an individual and the organization. Motivation. Organizational culture. Making a strategy. Run-downs of the internal and external environment. Run-downs of the internal and external environment II. Training: Group forming. The communication of a new leader. Problem solving in an organization. Time saving. Treatment of conflicts. Estimating employees.

Rudiments of law

I. Basic Concepts: The development and definition of state. The development and definition of legal system. Courts. Other organizations. II. The Introduction to Civil Rights: The definition and origins of civil rights. The statutes of civil rights. Proprietary terms. Obligations. III. Common Rules Regarding Contracts. IV. Liability for Compensation of Civil Rights: About civil rights liabilities in general. Liability based on general delinquency. V. The Main Means of Public Relations of Economic Organizations, Contracts: Buying and selling. Rental. Delegation. Enterprise. VIII. The Participants of Economy: About economic organizations in general, General partnership, Limited partnership, Limited-liability company. IX. Employment.

Ethics for engineers

Ethics and moral philosophy. The difference between the scientific and moral law. The meaning of “ethics for engineers” and its validity. Justice and moral. The relation of technique and ethics. The engineers and the society. The engineer and the protection of environment. The energy and the engineers. The engineer as designer. Ethical codex for engineers.

Core professional classes

Machine elements and design

The general procedure for design, conceptual design. Joints and fasteners, screw thread mechanics. Shafts, shaft connections, clutches and couplings, design for dynamic loads, critical speeds of shafts. Bearings, linear guides. Principles of vibration, active and passive methods for vibration reduction. Mechanical transmissions, belt and chain drives. Gears, high power density transmissions. CVTs (continuously variable transmissions). Principles of mechanism.

Utilization of Wood

The subject discusses the general characteristics of the forestry and the timber industry. The international aspects of forestation, use of wood and the woodworking are covered by the subject as well. Further topics are the Hungarian forestry wood chain, including the wood market. The assortments of the removal and the most important characteristics of the wooden forest products will be discussed. The range, properties and utilization of the most important 32 softwoods and hardwoods will be presented.

Wood preservation of wooden constructions

Within the frame of this curriculum, as introduction, the short history and the philosophy of wood preservation are presented. The taxonomy of wood fungi, their acting mechanisms and the influencing factors are presented and the most frequent wood damaging beetles and the caused injuries as well. From the possible wood protecting modalities the conditions for the “best technique” and the chemical protection, the substitutive or complementary solutions of preventing versus abating procedures and the temporary versus definitive protection are presented. The small scale and the industrial level wood preserving techniques. Types of wood preservatives on the Hungarian market. The relation of chemical wood preservatives with the environment.

Wood-Water relations

The importance of the water content of wood, the movement of water in the wood and the consequences is a very important issue in the wood science and in the wood working industry as well. In the frame of the subject the students get acquainted with the practical and theoretical significance of the wood-water relations. The theoretical background of the different moisture measurement techniques, the properties of free and bound water, the influencing factors of the equilibrium moisture content of wood (sorption, hysteresis, diffusion), fibre saturation point, the effect of moisture on the physical and mechanical properties of wood (shrinking-swelling, strength properties, etc.) will be discussed in detail. The practical importance of the involved theoretical issues will be shown as well. The study program involves lectures and exercises in the laboratory.

Theory of wood cutting

Determination of the concepts of woodcutting. Relations of force and tension. Deformation of chip. Slide cutting. Thermal loading of cutting-tools. Variation of cutting parameters taken as a function of physical and mechanical characteristics. Operation characteristics of tools in the wood industry: band-, circle-, frame- saw, tools. Operation characteristics of tools in the wood industry: milling-, planing-, drilling-tools. Energy need of cutting. Stability of tools in the wood industry. Vibration of tools and work piece. Abrasion of tools. Variation of superficial characteristics taken as a function of physical and mechanical characteristics. Mechanism of sanding process. Superficial roughness of sanding and planing.

Building Construction

Parts of building process. The influence of building laws on private- and industrial building operations. The judicial background of design and construction. The public procurement. Construction of building systems, possibilities of mounting of building materials. Landscaping and fundamental works. Horizontal and vertical bearing structures. Flat and high roof constructions, meteorological protection. Tiling and metal works, covering systems. Basics of building-physical and static design, function and parts of working drawings.

Specialized professional classes

Wood based panels

Adhesives of fiberboard and particleboard production and their characteristics and effect on end product. Scientific background of some technological aspects of fiberboard technology (fiber production, sedimentation, etc). Scientific background of some technological aspects of fiberboard technology (heat pressing). Drying of wood elements. Special technologies: bio composites Special technologies: wood-plastic composites Wood recycling I. Wood recycling II. Recent international researches on wood composites. Recent domestic researches on wood composites.

Inorganic bonded composites

Basics of inorganic bonded composite materials structure. The composition, binding mechanism of various inorganic binders (cement and gypsum) and using them as a matrix system in composites. Influence of total hydration time of regulated cement and gypsum using various additives. Influence of extracts (glucose, tannin, ect.) on the setting time and maximum hydration temperature of inorganic bonded composites materials. Creating the framework structure and characteristics of inorganic bonded composites materials. Producing composite system using various lignocellulosic materials of cement-and gypsum bonded composites materials special technologies. Control and assurance of properties, utilization of composites.

Anisotropic Elastic and Strength Theories of Wood and Wood-Based Composites

Programme: General characteristics of anisotropy, the formation of anisotropy in natural and artificial materials, the anisotropy of elasticity, the anisotropy of strength, the measurement of technical characteristics of elasticity and strength, the basic principles of dimensioning anisotropic materials according to the rules of forces. Professional requirements: To learn the information listed in the program of the course, to get skill and routine in solving the tasks mentioned in the goals of the course.

Finite Element Method

Programme: Historic outlines, the origin of the finite element method. Determination of the border value problem of elasticity and the classical methods of its solution. Beam construction, disc construction, plate and shell constructions. Solution of the border value problem with finite element method. Approximation based on the field of displacement. Galjorkin-Ritz method. Elements and groups of elements. Convergence and error analysis. Application of the finite element method in the mechanic design of constructions. Creation of models. Professional requirements: Theoretical knowledge of the finite element method and its application in practice in the design and analysis of simple constructions.

Product development

Based on the previous subjects this course reviews the problems related to product development and design, embraces the requirements for engineering data preparation, and introduces the organization and management activities necessary for product manufacturing. In the frame of this subject the following issues are discussed: invention and innovation; innovative problem solving techniques; value and product level analysis; product life cycles and related strategies; the product development process; rapid prototyping methods; the engineering data system; product hierarchy; engineering and production management. Beside to the general review of the enumerated topics a special attention is given to the wood industry's particularities. For a better understanding of the theoretical issues a practical project is elaborated.

Automation

Control of pneumatics. Hydraulic systems. Principles of proportional hydraulics. Digital and analogue measurement, data acquisition, signal condition. Open loop and closed loop control with PLCs, PID control. Principles of process automation. Principles of electrical drives, basics of the power electronics. Programmable relays. Circuit diagrams of the controlling system and the main electrical system.

Quality management

The main issues of this subject cover the modern interpretation of the quality concept, the revelation of the interrelationship between quality and design/production costs, the introduction of the most accepted quality systems and the review of wood industry's particularities in quality management systems. Topics discussed are as follows: quality definition, quality influencing factors, quality indices; economical and engineering consideration, quality costs and planning, quality management systems (ISO 9000, TQM, EFQM), the quality management certification process. A special attention is given on wood industry's particularities in quality management systems and wood products quality characteristics.

Applied wood anatomy

The historical development of applied wood anatomy and its relation to wood industry. The comparative analysis of hardwood and softwood anatomy. The anatomical description of bamboo and other grasses. The modeling possibilities for cell wall structure and its relation with the mechanical properties. The cell wall forming compounds and their integration into the cell wall. The relations between the anatomical structure and the technical and technological properties. The relation of annual ring structure with the physical properties and processability of wood. The characteristics of heart formation and its influence on wood.

Bonding and surface treatment of wood

The presented material deals with the theoretical aspects of gluing and surface finishing of wood. Overhauls the wood as adherent, wood properties that are influencing gluing, and their effect on the bonding process and quality. Analyses the interactions between wood surface and glue during the pressing process. Reviews the effect of additives, catalysts, pressing force, pressing temperature, pressing time, on the bonding process and quality. Analyses the bond quality and the related criteria. Within the topic of surface treatment the main theoretical acknowledgements, the main characteristics of film formulating materials and their particularities are discussed such as viscosity, tixotrophy, wetting, spreading. The mathematical and physical characteristics of the coat are presented, work of adhesion, work of cohesion, internal stresses, surface roughness, pore filling, anchoring. The vapor diffusion versus water repellent behavior and UV light reflecting and inhibiting properties are discussed as well.

Modification of wood

The market share of modified wood material is growing intensively. There are several applied industrial processes and even more newly developed technologies just before the industrial application. In the frame of the subject the students get acquainted with the purposes of the modification of the wood material. In order to offer a better understanding of the processes applied in the industry the theoretical background is discussed as well. In the lectures and laboratory exercises the modification techniques with oil, heat, steam, external mechanical forces, irradiation and biological treatments will be discussed in detail. Furthermore the effects of the treatments on the wood properties will be discussed, with special attention to density, strength properties, sorption properties, dimensional stability, equilibrium moisture content, natural durability, colour and technological properties (glue ability, etc). The effect of the anatomical properties on the success of the modification treatment is included in the subject as well. Additionally the possible uses of the modified wood will be discussed considering the market developments: plastics gain market share at the expense of wood. The study program involves lectures and exercises in the laboratory.

Market research

The basic ideas of market research. The research process. Setting up the plan. The application of secondary market research. The primary analyses. Sampling and selecting. Constructing questionnaires. Carrying out interviews. Panel surveys. The methods of qualitative market research. Qualitative techniques. The future of market research.

Building energetics

Energie supply and energetical politics. Active and passive methods of using possibilities of solar energy. Termical and photo-electrical utilization systems. Practical solutions of accumulating of heat. Zero-energy buildings, ecological and earth-houses. Practical solution of wind power. The utilization of geothermic energy and biomass for energetic. The energy-conscious architecture.

Timber in Architecture 1.

Building and architecture, the basic and the complex room, skeleton and wall building constructions. Vernacular timber architecture. Timber architecture in the antiquity and in the middle age, the „Fachwerk“-style, the renaissance and the baroque timber architecture. Historical sacral buildings with timber construction. Wooden housing in Europe and North-America, the connection between the early modern architectural movements and wood. Nowadays wooden-architectural trends: organic and neo modern buildings. Application of modern bearing structures, glulam beams, shells, three-dimensional girders. More-level timber buildings, earthquake-resistant wooden-houses, hybrid-constructions.

Timber in Architecture 2.

Typical wooden-houses. The structure and building of the timber-frame system. Small and large table system. The blockhouse categories and their constructive solutions. Prefabrication possibilities in the timber-house building. Design and building of house-elements made up traditionally of wood: roof-structure, gable-window, balcony, terrace, winter garden, wooden stairs.

Labour-safety – safety technique

The aim of labour-safety and its regulation: Noise- and vibrational- safety. Safety technique of electronics. Visual surrounding, illumination technique. Safety technique of the machines. Individual safety appliances. Accidents at the work. Safety technique of material transport. Fire defense.

Logistics

The concept, task and target of logistics. Determinant tendency developing in logistics. Moving of material, storing. Systems of transportation, information and direction. Distributional logistics. Material supply in a „Just in time“ (JIT) system. Opportunities and advantages of establishing trade logistic centres. Case studies, logistic systems. Modelling of processes, solving of tasks.

Methods of industrial measuring

Basics of the industrial measuring. Form and characteristics of measured signals. Classification and properties of the measured signals. Structures of analog measuring systems. Computer in measuring. Measuring of displacement. Measuring of mechanical volumes: measuring of force. Measuring of electrical volumes: efficiency. Measuring of thermal volumes: temperature. Measuring of dynamical signs: measuring of noise and vibration. Measuring of optical- and light technical volumes. Basis of measuring pneumatic techniques. Appliances of measuring air flow. The process and assessment of measuring. Measuring of air technique systems in the wood industry. Dust technical measurement: emission, immisions, measuring, dust exposition at the workplace.

Environment protection

Possible harmonization of the interactions of industrial technologies from an environmental aspect, based on the pattern of ecological relationships between natural beings. Requirements of sustainable development in the wood business, EU and national principles for environmental politics. The basics of management capable of carrying out the environmental policy (environmental management) based on the ISO 14000 standard series. Measuring environmental performance: full life cycle analysis (LCA). Practical examples on the environmental evaluation of wood products based on LCA.