Basic thematic areas for the Final State Examinations

Follow-up Master's degree program in Textile Engineering

Specialization: TEXTILE TECHNOLOGIES AND MATERIALS

AREA: TEXTILE MATERIALS **(contains questions from the subjects Properties of Fibres, Textile Chemistry and Textile Engineering)**	
1	Tensile curve, description and basic formulas. (strength, ductility, elasticity).
2	Determination of polymer density, use in fiber identification and analysis.
3	Stress and creep relaxation, basic equations and graphs.
4	Methods of analysis of internal structure and arrangement of polymers.
5	Generation of static electricity, ways to reduce the generation of static electricity.
6	Models of viscoelastic fiber behavior, including the Maxwell and Voight models, basic equations and model idea.
7	Geometric description of fibers (fineness, shape factor...), basic relations.
8	Methods of thermal analysis of polymers, principles, applications, transition temperatures semi-crystalline polymers.
9	Dynamic-mechanical analysis of fibers, method, application.
10	Polymers - basic concepts, properties, crystallinity, chemical composition.
11	Synthetic polymers and their preparation, properties of selected synthetic fibers.
12	Fibers from natural polymers, damage detection, chemical nature, fibers from regenerated cellulose.
13	Surfactants, properties and uses.
14	Textile finishing, pre-treatment, cotton pre-treatment processes.
15	Textile dyeing - basic concepts and principles, dyes and pigments.
16	Textile printing - basic principles, digital printing.
17	Finishing of fibers - principles of selected finishing (e.g. hydrophobic, non-flammable)
18	Fiber blending - reasons, complications in refining, analysis of fiber blends, bicomponent fibers.

19	Ecological aspects and textile recycling - key problems, recycling procedures, stability dyeing and durability of textiles.
20	Fibers (What is the difference between staple fiber and a filament? What are the characteristics of wool and polyester?)
21	Spinning (What is the basic difference between staple spun yarns and continuous filament yarns? What are the different methods of spinning?)
22	Weaving (Description of two sets of yarns present in woven fabrics? Which shedding mechanism we are able to use for weaving?)
23	Knitting (What are weft knitted structures? What are the parts of a needle?
24	Finishing (How do you evaluate wash fastness? What processes can be used in pretreatment of cotton?)
25	Nonwoven (What are the raw materials used for the production of nonwovens? What are the properties of spunbond nonwoven?)
26	Clothing (What is the purpose of a guide? What is a shuttle in a sewing machine?)

AREA: FIBER STRUCTURES AND THEIR EVALUATION **(contains questions from subjects Structure of Fibrous Assemblies, Special Measurement Methods and Statistics)**	
1	Basic parameters describing yarn. Helical yarn model, definition, assumptions.
2	Tensile stress and yarn strength provided the ideal helical one model. Relative elongation of the twisted bundle of fibers. Dependence of yarn strength on its curve.
3	Basic parameters of surface geometry of fabric, definition of limit delivery of threads in fabric.
4	Basic parameters of spatial geometry, model of fabric geometry in cross section, Peirce's fabric model, assumptions, fabric thickness.
5	Mechanics of fabrics using Peirce's model - non-deformable threads (elongation fabrics in two main directions, Poisson 's ratio), - deformable yarns (strength of the fabric in two main directions), explanation of the main principles.
6	Mechanics of fabrics - deformation of yarn in the binding point, Kemp's cross section.
7	Model of the geometry of the knitted fabric - covering, model shape of the eyelet, relative length threads in eyelet, limiting density.
8	Mechanics of knitwear - tensioning of knitwear in two main directions - basic notions, non - deformable x deformable yarns (parameter of reduction of effective yarn diameter), the strength of the knit in the direction of the row, posts.
9	Modelling of fiber orientation in the plane - principle of elastic substitution model band with spikes, the resulting probability density isotropic and anisotropic orientation in the plane. Principle of determining the orientation of fibers in the section.
10	Multiaxial fabrics - mechanical behaviour - geometry and forces in one thread, one system and in the whole multiaxial fabric (only the simplest solution for small deformations, linear tensile curve), the resulting relations for regular multiaxial textile.
11	Relationship between metrology, standardization, and testing. Standards, traceability schemes, conditions of accurate experimental work. Basics of estimation of measurement uncertainties.
12	Electromagnetic radiation I - basic concepts, radiation of an absolutely black body, sources light, light transmission through substances - scattering, right absorption,

	luminescence, fluorimetry, daylight visibility assessment of garments with high visibility.
13	Electromagnetic radiation II - optical activity, dichroism, polarimetry, interferometry, evaluation of retroreflection and visibility in high visibility clothing.
14	Microscopy I - theory of imaging and construction of light microscope, calculation magnification, resolution limit and numerical aperture, EPI and DIA illumination, polarization microscopy, phase contrast, phase contrast, Nomarski differential interference contrast, Hoffman modulation contrast.
15	Microscopy II - confocal microscopy, multiphoton confocal microscopy, confocal microscopy in materials engineering, microscopic measurements, electron microscopy, scanning probe microscopy. 2D optical measuring methods and 3D.
16	Basic colorimetry I - basic concepts, lighting, lighting sources. Instrumental technique - spectrophotometers, colorimeters and gonio spectrophotometers. Techniques non-contact measurement, multispectral image analysis.
17	Basic colorimetry II - colorimetric systems CIE XYZ, CIELUV and UCS - approx. uniform colorimetric systems. Equations for calculations of color differences.
18	Electrical properties of materials - conductivity theory, basic principles of measurement electrical and dielectric properties of materials.
19	Thermal properties of materials - basic thermodynamic concepts, measurement methods thermal thermodynamic properties of materials.
20	Digital image - creation, scanning, representation. Basic steps in image processing. Sampling and quantization. Basic types of images. Mathematical tools used in image processing. Basic relationships between pixels (neighborhood, connectivity, area, boundaries, distance measures)
21	Brightness transformations. Basic transformation functions. Histogram equalization.
22	Basics of spatial image filtering. Spatial correlation and convolution. Smoothing. Smoothing linear spatial filters. Smoothing nonlinear spatial filters.
23	Descriptive statistics - data types, graphical procedures for data display (histogram, pie chart, boxplot, scatter plot, etc.), position characteristics (average, median, mode, quantile), variability characteristics (variance, standard deviation, coefficient of variation, range, interquartile range...)
24	Probability - Random variable and its characteristics: distribution function, mean, median, quantiles, mode, density, probability function.

25	Examples of the most important random variables with discrete and absolutely continuous distribution: alternative, binomial, Poisson, geometric, hypergeometric, uniform, exponential, normal distribution.
26	Basic concepts of mathematical statistics: random selection, parameter estimates-point and an interval estimate (confidence interval) for the mean, variance, and parameter binomial distribution, hypothesis testing principle, first and second kind of error, test level, t-tests, Wilcoxon test, analysis of variance.
27	Correlation analysis: Pearson correlation coefficient, Spearman correlation coefficient, correlation coefficient tests.
28	Regression analysis Linear regression - model, principle and method of estimation (method least squares), linear regression tests.

AREA: TEXTILE TECHNOLOGIES AND MATERIALS **(contains questions from subjects Processes and Systems in Spinning, Construction and Properties of Yarns, Processes and Systems in Weaving, Construction and Properties of Woven Fabrics, Processes and Systems in Knitting, Construction and Properties of Knitted Fabrics)**	
1	Analysis of disassembly, cleaning, mixing processes (principles, implementation) in preparation spinning material. Carding system analysis (principle, spinning processes of the system carding, process analysis: disintegration, cleaning, pulping, straightening and straightening the fibers on a carding machine; mutual position of carding coatings)
2	Analysis of the refining process. Stretching a bundle of fibers between pairs of rollers - ideal delay. Concept and division of traction devices. Twisting machines. System analysis combing - realized processes, combing principle. Comparison of carded and combed properties yarn.
3	Reinforcement of longitudinal fibrous structure - essence, methods. Permanent bend and false - conditions of creation, use in spinning technology. Wing analysis pre-spinning system, the process of twisting and winding on the wing pre-spinning machines. Analysis of the ring spinning system - the process of twisting and winding on a ring spinning machine. Analysis of compact spinning. Twist triangle.
4	Rotor spinning system - analysis of main technological processes. Jet spinning system - analysis of the main technological processes. Comparison of properties rotor and jet yarns.

5	Mass inhomogeneity of longitudinal fibrous structures - ways of expression a evaluation. Possibilities of ensuring mass non-uniformity in technology yarn production.
6	Define technological parameters: fineness T [tex], bend Z [m^{-1}] and what is their relationship with yarn diameter D [mm] and twist rate (α [$ktexm^{-1/2}$], a [$ktexm^{-2/3}$], κ [-]). Describe experimental procedures for the analysis of these technologies' parameters, including procedures using image analysis and, where appropriate, indication of restrictions procedures.
7	Define and state the procedures setting out the basic indicators for quality assessment lengths. Define the factors influencing the quality of length structures. Define Uster Statistic and what it is used for.
8	State and describe the basic types of fancy yarns, including a description of the properties to be when verifying their quality, including properties using image analysis, e.g. for chenille yarns, "slab yarn", "wrap yarn", core yarns.
9	Use of cross - sections of yarns, oblique cuts of yarns and longitudinal views of length fabrics when defining the parameters of length fabrics.
10	Define qualitative indicators of length fabrics affected by the way of arrangement fibers in yarn. Describe the factors influencing the arrangement of the fibers in the yarn. Define qualitative indicators of length fabrics related to the surface structure of yarns.
11	Formation of the binding point of the fabric (characteristics of the binding point, basic model of the binding point, binding point in the fabric, weft impact, relationship between impact force and weaving resistance, impact pulse, fabric front, weft slip and warp thread stretching, elastic and the adhesive force of the weft stroke, etc.)
12	Shed creation on a weaving machine (technical means for shed creation, single-lift and double-lift shed mechanisms, basic functions of the warp clamp on the weaving machine, forces in the warp threads, compensation of unwanted forces during weaving cycle, means of external regulation of the weaving process, etc.)
13	Weaving machine switching systems (basic systems with a fixed carrier and systems jet, technical means for weave realization, basic phases of weft weaving, tensograph and weft pass tachograph for individual weft systems, etc.)
14	Tensile, shear, torsional and bending stresses. Determination of stress and strain. Explanation of the concept of stress, relative stress, deformation and Poisson's ratio.

15	Explanation of the concept of internal forces and internal balance of the body. Explanation and derivation modulus of elasticity and volume modulus.
16	Viscoelastic model of body behavior. Description of the behavior of the viscoelastic body and description basic models.
17	Construction of leaf and jacquard fabrics. Basic division of fabric patterning. Binding techniques in patterning. Preparation of jacquard fabric construction using CAD system.
18	Identification of thread intertwining in fabric, coefficient of intertwining, structural cells weaving, wavy threads in the fabric.
19	Surface and spatial geometry of the fabric in relation to the properties of the fabric. Definitions an expression of the basis weight of the fabric. Definition and expression of surface covering of fabric. Definition and derivation of thread encounters in fabrics using a linear model for expression of the binding wave shape.
20	Flat knitting machines (for making knitted knitwear). Design solutions of machines. Working system - individual parts and their functions. Device for feeding the input material - functions of individual parts. Sampling device - principles of needle selection. Covering a marquetry wire. The principle of knitting marquetry and covered ties. Drainage system knitwear features individual part
21	Large-diameter circular knitting machines. Design solutions of machines. Working system - individual parts and their functions. Device for feeding the input material of the function individual parts. The device for draining the knitwear functions of individual parts.
22	Small-diameter circular knitting machines. Design solution of machines (division of machines from in terms of bed layout). The process of making socks - the specifics of the formation of the hem, calf, heels, toes. Ways to end the tip. Basic working mechanisms of machines.
23	Preparation of production for warp and warp knitting. Requirements for initial knitting material. Specification of knitting yarns (staple and filament yarn) and their required knitting properties. Relationship between machine division and fineness input material.
24	Performance of knitting machines. Determination of machine utilization coefficients.
25	Construction of weaves of stretch knitwear (single-sided, double-sided, double-sided). Properties (precipitation, twisting, steam ability, dimensional stability, etc.) and their use with respect to the product design. Binding options for patterning

	(exclusion, restriction and interruption needle activity).
26	Special technical ties for stretch knitwear. The essence, creation and their construction. (Fixed beginnings in single-sided and double-sided ties. Splitting series during knitting binding of various piece products.) The principle of implementation on flat knitting machines.
27	Surface and spatial shaping (methods of expansion, narrowing, or dropping, hanging technique), principle, conditions, and design on knitting pulleys flat machines with regard to their possibilities.
28	Product termination in draw knitting technology. Solution variants for single-faced and double-faced ties. Methods of implementation.