FACULTY OF TEXTILE ENGINEERING TUL

Basic thematic areas for the Final State Examinations

Follow-up Master's degree program in Textile Engineering

Specialisation: CLOTHING TECHNOLOGY 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 identification and analysis of fibers.
3	Stress and creep relaxation, basic equations and graphs.
4	Methods of analysis of internal structure and arrangement of polymers.
5	Static electricity generation, ways to limit static electricity generation.
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 of 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, pretreatment, cotton pretreatment 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 of 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 spun bond nonwoven?).
26	Clothing (What is the purpose of a guide? What is a shuttle in a sewing machine?).

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	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 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	Modeling 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 behavior - 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 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.
26	Correlation analysis: Pearson correlation coefficient, Spearman correlation coefficient, correlation coefficient tests.
27	Regression analysis Linear regression - model, principle and method of estimation (method least squares), linear regression tests.

	AREA: CLOTHING TECHNOLOGIES AND MATERIALS
	(contains questions from the subjects Chapters of Garment Manufacture Technology, Computer-aided Pattern Design, Principles of Clothing Machines, Automation of Apparel Production, Computer Simulation of Clothing Production, Utility Properties of Clothing Materials and Advanced Technology and Measurement)
1	The principal task of product engineering and production planning in the clothing industry. Division of product engineering and characteristic of technical documentation. Parts of production management - documentation and its use in clothing manufacture. Basic activities of the technologist, description of the list of operations, its parts, rules and uses.
2	Specification of the basic differences between lined and unlined garments. Basic types of assembly of lined garments, graphical representation.
3	Production of clothing from fabrics and knitwear - the influence of sewn material on the technology of production, machinery, seams and stitches.
4	Body measurement and measure methods, taking body measurements, dynamic body measurements analysis, proportion.
5	Principle of 3D-2D body surface flattening and creation of a pattern constructional net of clothing, description of basic vertical and horizontal net lines. Size designation of clothes, sizing system, primary and secondary body dimensions. Grade rule calculation.
6	Hardware and software of CAD systems used in the clothing industry. Pattern pieces digitization and grading. Procedures of lay planning and marker-making.
7	Mass customization - made to measure (MTM) in clothing production. The principle of MTM customization using computer technology.
8	Charge formation, loading parameters and means for charge generation. Technology separation. Conventional and unconventional ways of dividing the charge into parts (characteristics, suitability for use, principle of loading and separating machines).
9	Manual ironing. Machine ironing, ironing presses and carousels. Special types of ironing and shaping. Theoretical principles of shaping textile materials.
10	Principles of gluing. Undercutting machines, automation elements for hemming machines. Underlay material, types and properties.

11	Joining material by sewing. Division of sewing machines. Sewing machine mechanisms, cyclogram. Machine sewing needle (shape, numbering, stress in the sewing process). The principle of creation machine stitch.
12	Sewing threads (division, numbering, properties).
13	Unconventional methods of joining textiles (ultrasonic welding, hot welding wedge, hot air welding - seam sealing, high frequency welding, riveting, gluing). Seam strength, seam efficiency, theoretical seam strength.
14	Basic principles of automation in the textile and clothing industry. General automation goals. Basic terms and definitions of mechanization and automation.
15	Types of drives and their properties in connection with clothing production. Schemes and principles of fluid drives (pneumatic, hydraulic). Speed, direction, force and flow control
16	Garment conveyor systems, and their applications. Organization of production lines, and transport in clothing workshop.
17	Simulation definitions. Discrete and continuous systems. Phases of creating a simulation model. Basic elements of discrete models.
18	Optimization of simulation models. Principle of evolutionary optimization algorithms (blind algorithm, climbing algorithm, simulated annealing).
19	Classification of clothing materials according to their function in the clothing product (top, lining, etc.) and their useful properties.
20	Evaluation of stability and resistance of clothing materials (abrasion, abrasion, lint, creasability, flowability, stiffness, shrinkage, etc.).
21	Clothing comfort, its components. Thermoregulation of the organism. Methods of heat transport and moisture in the clothing system. The principle of layering clothes for sports and leisure, rules layering, materials and requirements for individual layers.
22	Evaluation of transport properties (breathability, thermal insulation ability, water and water vapor permeability) of textiles and clothing (thermal mannequin).
23	Tactile evaluation using the KES system.
24	Measurement of temperature, temperature fields. Application of thermal imaging methods in clothing processes production.

25	Use of image analysis for measuring selected properties of textile materials.

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