

Basic thematic areas for the Final State Examinations

Follow-up Master's degree program in Industrial Engineering

AREA: QUALITY CONTROL (contains questions from the subjects Quality Control, Systems of Quality Assurance and Planning of Industrial Experiments)	
1	Statistical acceptances - purpose, principle, division, operational characteristics, essence calculation of acceptance plans
2	Purpose and essence of the use of control diagrams, assumptions about data, distribution control charts.
3	Shewhart control diagrams - construction, Shewhart control diagrams measurement and comparison, comparison with other control diagrams (advantages and disadvantages)
4	Other control diagrams - CUSUM, EWMA, target, standardized, for several quality characteristics at the same time.
5	Eligibility indices - use, distribution.
6	Loss function - principle of loss function, purpose of use, types of loss functions, loss function and quality costs.
7	Quality management system according to ISO 9000 series standards - 7 principles according to standard ISO 9000: 2016, basic structure and subject of ISO 9001: 2016 standard, risk consideration, organization context, PDCA cycle in the set of ISO 9000 standards, basic structure and subject of standard ISO 9004: 2019.
8	7 basic and 7 "new" tools for quality management - flow chart, cause and effect diagram, data collection form, Pareto diagram, histogram scatter diagram, control diagram, affinity diagram, relational diagram, tree diagram, matrix diagram, matrix data analysis, decision diagram, network diagram.
9	Measuring the satisfaction of external customers - the importance of system measurements in quality assurance systems, customer satisfaction model according to ISO 10004: 2018, planning, design and development and implementation of the process of measuring satisfaction customer, the relationship between customer expectations and customer satisfaction, selected models for analysis of obtained data (customer satisfaction indices, customer window, analysis value for the customer)



10	Quality management in the pre-production phase - quality planning procedures and their importance, selected quality planning methods (QFD, design review, product FMEA, FMEA process, FTA)
11	Quality assurance and analysis of the measuring system - measurement uncertainty, basic concepts (repeatability, reproducibility, etc.), R&R analysis, use of indices competence in the analysis of the measuring system.
12	Network graphs - distribution, characteristics, AOA, AON graphs, characteristics of CPM graphs and PERT.
13	Audit, self-assessment, and benchmarking in quality management systems - goals, methods, procedures.
14	Other methods and approaches to quality management (TQM, Kaizen, Six-sigma) - goals, methods, procedures.
15	Quality and environmental protection - sustainable consumption and production, system environmental management, environmental labelling I., II. and III. type, general principles of environmental labelling, eco-design of the product.
16	Conformity assessment in quality assurance systems (regulated and unregulated area) - related terms, principles, procedures, related legislation, CE mark, modular concept.
17	Planning experiments - basic steps, basic concepts (response, factor, interaction, replication, randomization, blocking).
18	Methods of evaluation of a one-factor comparative experiment depending on response character – description.
19	Regression experiment with one factor. Statistical model of the experiment - one factor, two factors.
20	Complete multifactorial experiment 2^N for $N = 2, 3$. Test of significance of effects in complete multifactorial experiment.
21	Taguchi's experiments - description.
22	Graphical representation of experiment 2^2 or 2^3 . Significant points of the proposal.
23	Partial multifactorial experiment. Plan generator.

AREA: METROLOGY (contains questions from the subjects Textile Metrology and Quality Control, Special Measurement Methods, Analysis and Evaluation of Image Data, Statistics)

1	Definition of quality. Loss function. Utility value.
2	Evaluation of fiber quality. Ideal thread and identity diagram. Quality indices.
3	Evaluation of yarn quality. Relationships between fiber and yarn properties.
4	Evaluation of the quality of fabrics. Subjective evaluation and prediction of touch (system KES). Thermal comfort (measurement and prediction methods)
5	Measurement errors. Instruments operating with constant absolute error and with constant relative error. Additive and multiplicative measurement models.
6	Measurement uncertainties.
7	Calibration. Procedure for creating a calibration model, use of the calibration model, types calibration.
8	Relationship between metrology, standardization, and testing. Standards, traceability schemes, conditions of accurate experimental work. Basics of estimation of measurement uncertainties.
9	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.
10	Electromagnetic radiation II - optical activity, dichroism, polarimetry, interferometry, evaluation of retroreflection and visibility in high visibility clothing.
11	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.
12	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.
13	Basic colorimetry I - basic concepts, lighting, lighting sources. Instrumental technique - spectrophotometers, colorimeters and gonio spectrophotometers. Techniques non-contact measurement, multispectral image analysis.



14	Basic colorimetry II - colorimetric systems CIE XYZ, CIELUV and UCS - approx. uniform colorimetric systems. Equations for calculations of color differences.
15	Electrical properties of materials - conductivity theory, basic principles of measurement electrical and dielectric properties of materials.
16	Thermal properties of materials - basic thermodynamic concepts, measurement methods thermal thermodynamic properties of materials.
17	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)
18	Brightness transformations. Basic transformation functions. Histogram equalization.
19	Basics of spatial image filtering. Spatial correlation and convolution. Smoothing. Smoothing linear spatial filters. Smoothing nonlinear spatial filters.
20	Highlight space filters. Using second derivatives to sharpen an image - Laplacian. Use a fuzzy mask to sharpen the image.
21	Image segmentation - global, local, dynamic thresholding. Image Segmentation - detection of points, lines and edges, edge operators, Hough transform.
22	Mathematical morphology. Dilation. Erosion. Opening and closing. Basic morphological algorithms on binary images.
23	Measuring the properties of objects or areas of interest in an image (area, perimeter, center of gravity, orientation, equivalent diameter, eccentricity, bounding box, convex envelope, etc.)
24	Color image processing. Colored spaces. Color transformations. Filtration color images. Segmentation of color images.
25	Descriptive statistics - types of variables, frequency distribution, graphical data processing (histogram, box plot). Basic characteristics of position and variability, quantile, skewness, and sharpness.
26	Random variable. Probability distribution. Distribution function and its properties, density, quantile function. Characteristics of a random variable - mean value and dispersion.



27	Distribution of a random variable with discrete distribution (alternative, binomial, Poisson, hypergeometric) and with a continuous distribution (exponential, uniform, Weibull)
28	Normal distribution, central limit theorem.
29	Basic principles of estimation - point and interval estimation, basic estimates.
30	Hypothesis testing - basic principles and concepts, t-tests, goodness-of-fit tests.
31	Analysis of variance.
32	Alternative procedures to assumption-based statistical procedures normality - ordinal tests, L-estimates.
33	Correlation analysis - Pearson's and Spearman's correlation coefficient, Z-transform, tests on the values of the correlation coefficient.
34	Linear regression, least squares method, tests and estimates in regression.

AREA: TEXTILES PROPERTIES (contains questions from the subjects Fiber Engineering, Comfort and Transport Properties of Textiles and Textile Engineering)

1	Structure of matter - atoms, structure of atom, molecules, chemical bond, intermolecular forces.
2	Polymers - structure and methods of synthesis, average degree of polymerization, molecular mass.
3	Stability of polymers - degradation of polymers by radiation, identification of polymers by FTIR, average degree of polymerization by viscosity process, dissolution, swelling.
4	Polymer treatment - copolymers, crosslinking, additives, matting, photocatalysis, pigments.
5	Production of fibers and supramolecular structure of polymers - production of fibers from melt a solution, elongation, analysis of supramolecular structure.
6	Structure and description of fibers - fiber length, fineness, fiber cross-sectional shape, nanofibers, specific surface, density, melting point, identification, sorption



	properties of fibers.
7	Fibers - natural, chemical, synthetic fibers - basic properties, detection chemical damage to the fibers.
8	Modification of fiber properties - refining, fiber pre-treatment, fiber dyeing, dyes, dye toxicity, dyeing theory, dyeing technology.
9	Fiber blends - reasons for blending, problems in refining and blended production textiles, bicomponent fibers, qualitative analysis of fiber mixtures.
10	Production and description of fibrous structures - textile technologies, production processes, yarns, fabrics, knitwear and nonwovens, textile description, basis weight.
11	Properties of fibrous structures - filling, visualization of fibrous structures, stability coloring, grey scale, blue scale.
12	Modification of fiber properties - textile printing, finishing, flammability, wettability, pilling, tanning, plasma, laser treatment.
13	Fiber structures in applications - transport processes, encapsulation, examples of applications.
14	Ecology and fiber recycling - textile maintenance, washing, surfactants and detergents, toxicity fibers, microplastics, recycling of fibrous materials.
15	Psycho-sensory principles of human perception and regulation of heat in the body, skin's response to heat / cold around.
16	Heat transfer by conduction and passage, differences between these two transfers, Fourier's law heat transfer, Newton's law of cooling.
17	Heat transfer by radiation, Wien's law, differences in black and grey body radiation.
18	Thermo-physiological comfort of the human body, basics of water vapor transmission between human body and environment.
19	Textile moisture management and the effect on the feeling of body comfort, methods of detection thermo-physiological properties.
20	Sensory comfort of the human body, the difference between the immediate response of heat sensitive skin sensors on first contact and prolonged contact.
21	Thermo-insulating behavior of textile materials, expression of thermal insulation by duty and thermal resistance values.



22	Semipermeable membranes and similar layers in textiles, their function in general layering of clothes, advantages, and disadvantages of their use.
23	Fibers (What is the difference between staple fiber and a filament? What are the characteristics of wool and polyester?)
24	Spinning (What is the basic difference between staple spun yarns and continuous filament yarns? What are the different methods of spinning?)
25	Weaving (Description of two sets of yarns present in woven fabrics? Which shedding mechanism we are able use for weaving?)
26	Knitting (What are weft knitted structures? What are the parts of a needle?)
27	Finishing (How do you evaluate wash fastness? What processes can be used in pre-treatment of cotton?)
28	Nonwoven (What are the raw materials used for the production of nonwovens? What are the properties of spun bond nonwoven?)
29	Clothing (What is the purpose of a guide? What is a shuttle in a sewing machine?)