TECHNICAL UNIVERSITY OF KOŠICE
Faculty of Electrical Engineering and Informatics

Department of Electric Power Engineering
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State examination – Topics for the State Exam Subject

Academic year:	2023/2024
Department:	Department of Electric Power Engineering FEI TUKE
Study program:	Electrical Power Engineering
Study branch:	Electrical and Electronics Engineering
Academic degree:	2. - Master
Subject of state examination:	Main Knowledge of Study Field of Electrical Engineering and its Use

Topics and questions:

1 Topic 1 Electrical wiring and distribution equipment

a. Power distribution in civil buildings and industrial enterprises.
b. Cable lines - construction, marking, laying.
c. Rules for dimensioning and protecting electrical wiring.
d. Climatic conditions of mechanical calculation of lines.
e. Mechanical calculations of overhead power line conductors (symmetrical, asymmetrical field).
f. Power stations - general distribution, dimensioning of distribution equipment according to the effects of short-circuit currents.
g. Basic parts of distribution equipment (busbars, supports, bushings, switching devices, fuses, instrument current transformers, instrument voltage transformers).
h. Single-line diagrams for electrical stations.
i. Branches in MV, HV, UHV distribution equipment.
j. Distribution of distribution equipment from the structural point of view (external, internal, encapsulated).

2 Topic 2 Electricity transmission and distribution

a. Electrical power system, types of distribution systems, load diagram.
b. Electrical parameters of electrical power system elements (overhead and cable lines, alternators, transformers, capacitors, inductors, loads).
c. Solution of simple electrical lines powered from one and two sides.
d. Solution of electrical lines with distributed parameters.
e. Compensation of electrical lines and compensation of reactive power at the consumer.
f. Three-phase short-circuit powered by an ideal voltage source, peak short-circuit current.
g. Time behavior of short-circuit current in the real three-phase circuits. Mathematical expression of time behavior of short-circuit current components.
h. Transformation of unsymmetrical multiphase system into symmetric components - Fortescue method.
i. Calculation of unsymmetrical short-circuit currents I_{k2}'', I_{k2E}'', I_{k1}''.
j. Single phase-to-earth fault solutions in isolated and compensated medium-voltage networks.

3 Topic 3 High voltage technique and diagnostics of power engineering equipment

a. Homogeneous and inhomogeneous electric fields. Electrical strength of the environment.
b. Discharge phenomena in inhomogeneous electric field. Barrier in an inhomogeneous electric field.

c. Electric breakdown in a homogeneous electric field. Paschen's law, its use in practice.
d. Corona discharge at alternating voltage and corona losses.
e. Discharges along a solid insulator at the interface of two solid-gas dielectrics. Protection against surface discharges.
f. Insulation system of electric power equipment. Effect of degradation factors on its lifetime.
g. Polarization of dielectrics. Measurement of charge and discharge currents.
h. Loss factor of high voltage insulation. Influence of temperature, voltage and frequency on change of loss factor.
i. Measurement of partial discharges in an insulation of high-voltage equipment.
j. Oil-paper insulation system.

4 Topic 4 Lighting technology

a. Basic lighting terms and quantities: luminous flux, luminous intensity, intensity of illumination, brightness.
b. Spectral sensitivity of the visual system, photopic, scotopic, mesopic vision.
c. Types and principles of light sources.
d. Light technical parameters of light sources.
e. Characteristics of daylight, artificial and combined lighting of indoor work places.
f. Principles of work places lighting.
g. Principles of road lighting.
h. Principles of sports lighting.
i. Requirements for emergency lighting of interior places.
j. Maintenance of lighting systems.

5 Topic 5 Digital protections in the electrical power system

a. The role of protections in the electrical power system, basic requirements for electrical protections.
b. Structure of digital protections.
c. Current and voltage instrument transformers for supplying of protections.
d. Line protection by overcurrent protection.
e. Distance protection of lines, distance protection communication.
f. Protection against earth faults in high voltage networks.
g. Automatic reclosing.
h. Protection of synchronous generators.
i. Transformer protection.
j. Protection of synchronous and asynchronous motors.

6 Topic 6 Electrical power system operation management

a. Electrical power system, characteristics of electrical power system in Slovakia, peculiarities of electrical power system in terms of control, interconnected electrical power systems.
b. Economical distribution of load in general, technology and regime economy, methods of solution.
c. Economical load distribution in the power system without and considering grid losses.
d. Economical load distribution in the hydro-thermal electric power system.
e. Power quality management, relation of power balance and quality indicators, static load characteristics.
f. Primary, secondary and tertiary frequency control in the power system, power number.
g. Automatic regulation of frequency and transmitted power in the Slovak power system.
h. Methods of regulation of voltage and reactive power in power system.
i. Reactive power sources and appliances.
j. Regulation of voltage and reactive power in the Slovak power system (primary, secondary and tertiary regulation of voltage and reactive power in the Slovak power system).

7 Topic 7 Power plants

a. Circuits of energy carriers in conventional thermal power plants.
b. Thermal cycles, T-s diagram.
c. Steam-gas power plants, steam-gas cycle.
d. Methods of hydro power plants fall retrieving, pumped storage hydro power plants and their operating modes.
e. Description and basic types of nuclear power plants, thermal diagrams of nuclear power plants.
f. Description and design of the VVER 440 block.
g. Renewable energy sources in general.
h. Use of solar and wind energy.
i. Biomass, Biogas and geothermal energy.
j. Electrical part of power plants.

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