**2025 Oral exam topics**

**1. Physical-chemical basis of signal parameters. Main parts of an analytical instrument. The process of analytical measurements. Calibration methods. Parameters characterizing measurements. Signal-to-noise ratio.**

**2. Principles of potentiometric methods. Potentiometric electrodes. Potentiometry in practice.**

**3. Principles of conductometric methods. Conductometry in practice.**

**4. Voltammetric methods. Voltammetry. Polarography. Amperometry.**

**5. Principles of the major spectrochemical methods. Spectral regions. Spectrum. Lambert Beer law.**

**6. Spectrophotometry in practice. The operating principles of single-beam and double-beam spectrophotometers. Monochromators. Cuvettes. Photomultiplicator tube.**

**7. Principles of molecular spectroscopy. IR activity of compounds. Types of infrared vibrations. Characteristic vibrational frequencies of bonds. Information obtained from IR spectra. IR spectrometer. Applications.**

**8. Principles of atomic spectroscopy. Atomic absorption and emission techniques. Atomic spectra. Atomization methods. ICP. Atomic spectroscopy in practice. Atomic spectrometer.**

**9. Principles of Nuclear magnetic resonance spectroscopy (NMR). Chemical shift. Spin-spin interactions (coupling). Coupling constant (J). Proton NMR spectrum of ethanol. The NMR spectrometer.**

**10. Principles of fluorescence spectroscopy. Stokes shift, quantum yield. Instrumentation. Applications.**

**11. Principles of chromatographic separations. Types of chromatographic methods. Chromatographic parameters. Chromatogram. Qualitative and quantitative evaluation.**

**12. Principles of high performance liquid chromatography (HPLC). HPLC in practice. HPLC instrument. Injection. Columns. Detection methods.**

**13. Principles of gas chromatography (GC.) GC in practice. GC instrument. Injection. Columns. Detection methods.**

**14. Electrophoresis: theoretical background. Electroendosmotic flow (development, advantages and elimination). Theory and practice of capillary zone electrophoresis. Capillary electrophoresis instrument. Principles of capillary isoelectric focusing, gel electrophoresis, micellar electrokinetic chromatography and electrochromatography. Chiral capillary electrophoresis. Microchip gel electrophoresis in practice.**

**15. Principles of thermal Analysis. Thermal Gravimetric Analysis (TGA). Differential Thermal Analysis (DTA). Differential Scanning Calorimetric (DSC).**

**16. Principles of mass spectrometry. General scheme of a mass spectrometer. Analytical information obtained from the mass spectra. Types of ion sources (electrospray, electron impact, MALDI)**

**17. Types of mass analyzers (quadrupole, ion trap, time of flight). Detectors.**