Atomic absorption spectrometry (AAS I)

1. The principles of the method.
2. Differences between emission atomic and absorption atomic spectrometry (comparison of AAS with optical emission spectrometry techniques).
3. Apparatus:
   - radiation sources: hollow cathode lamps, electrodeless discharge lamp, xenon lamp (continuous radiation source)
   - atomizers,
   - nebulizers,
   - detectors (photodiode, photocell, photomultiplier, CCD matrix).
4. Interferences.
5. Calibration techniques (standard curve method, standard addition method, etc.).
6. Knowledge of the exercise procedure.

Atomic Emission Spctriometry (AES)

Flame Photometry (FP)

1. Structure of matter (element, atom, isotope, molecule).
2. Atomic emission spectrum.
3. Meaning of terms: excitation energy, resonance level, etc ...
4. Nebulization (nebulizers and spray chambers).
5. Atoms excitation in arc, spark, flame, plasmas (ICP, MIP).
6. Apparatus used (flame photometer, flame atomic emission spectrometer - FAES).
7. Optical system (prisms, diffraction gratings, interference bandpass filters)
8. Detectors (photodiode, photocell, photomultiplier, CCD matrix).
9. Calibration techniques (standard curve method, standard addition method, etc.).
10. Knowledge of the exercise procedure.

UV-VIS Spectrophotometry (SPF I, SPF II)

1. Energy of a molecule.
2. Wavelengths of electromagnetic radiation corresponding to the ranges: UV, VIS and IR.
3. The quantum theory of radiant energy.
4. Interaction of electromagnetic radiation with matter. Rotational, oscillating and electronic spectra.
5. Absorption laws: Lambert-Beer and additivity laws.
6. Reasons for deviations from Beer's law.
7. Block diagram of the spectrophotometer.
8. Sources of radiation.
9. Monochromators: filters, prisms, diffraction gratings.
10. Photodetectors: photovoltaic cells, photodiode, photocells, photomultipliers.
11. Sensitivity of spectrophotometric methods.

12. Chromophores, auxochromes, batochromic and hypsochromic effect.
13. Basic terms and units used (eg, analytical wavelength, wave number, etc.).
14. Calibration techniques (standard curve method, standard addition method, etc.).
15. Knowledge of the exercise procedure.

VOLTAMMETRY

1. Polarographic and voltammetric electrodes. Three electrode system.
2. Currents in polarography.
3. Diffusion current. Ilkovič equation.
4. The role of supporting electrolyte.
5. Oxygen waves.
6. Qualitative and quantitative polarographic/voltammetric analysis.
7. Calibration techniques (standard curve method, standard addition method, etc.).
8. Knowledge of the exercise procedure.

ION SELECTIVE ELECTRODES (ISE)

1. Ion selective electrodes - principles. Nernst equation.
2. Types of ISE.
3. Construction and operation of ion selective electrodes.
4. Ion selective electrode potential, Nikolsky-Eisenman equation.
5. Electrode selectivity coefficient.
6. Application of ion selective electrodes.
7. Knowledge of the exercise procedure.

GAS CHROMATOGRAPHY (GC I, GC II)

1. General aspects of chromatography. General concepts of analytical chromatography.
2. Apparatus (sample introduction, columns and stationary phases, detectors, etc.).
3. Parameters of chromatographic process (gas flow rate, type of stationary phase, column length, temperature).
4. Qualitative analysis.
5. Quantitative analysis:
- external calibration technique,
- internal calibration technique.
6. Knowledge of the exercise procedure.