MEDICAL UNIVERSITY – PLOVDIV
Faculty of Pharmacy

ANALYTICAL CHEMISTRY
SYLLABUS

1. The scope of analytical chemistry. Objectives and tasks of analytical chemistry. Definitions and basic concepts: sample analyte, matrix method, a methodology for analyzing, interfering components. Classification of methods of analytical chemistry.
2. Chemical equilibrium. Law of mass action. Equilibrium constant. Real and ideal systems. Activity coefficient. Equilibrium in heterogeneous system.
3. Acid-base theories. The Brønsted-Lowry theory. Autoprotolysis, autoprotolysis constant. Factors affecting the strength of acids and bases.
4. The hydrogen ion exponent. pH scale in various solvents.
5. Acid-base equilibrium of strong monoprotic acids and bases. Calculations.
6. Acid-base equilibrium of monoprotic weak acids and bases. Calculations.
7. Graphical representations of acid-base equilibrium of monoprotic weak acids and bases.
8. Acid-base equilibrium of polyprotic acids and bases.
9. Buffer solutions. Buffer capacity.
10. Volumetric methods of analysis. Principles. Requirements to the analytical reaction. Classification. Basic terms: titration, titrant, equivalent and end pint, titration curves. Preparation of standard solutions. Titration and titrimetric methods.
11. Acid-base titration in aqueous solutions. Titration of monoprotic strong acids and bases. Titration curves and indicators.
12. Acid-base titration in aqueous solutions. Titration of monoprotic weak acids and bases. Titration curves and indicators.
13. Acid-base titration in aqueous solutions. Titration of polyprotic acid and strong base. Titration curves and indicators. Titrations of mixture.
14. Acid-base titrations in nonaqueous solvents. Solvents classification
15. Acid-base titrations in nonaqueous medium. Principles. Solvents, titrants and indicators in nonaqueous medium. Possibilities of the method. Application in pharmaceutical analysis.
16. Acid-base titration in nonaqueous medium. Advantages and disadvantages of methanol as a solvent.
17. Acid-base titrations in nonaqueous solvents. Titrations in glacial acetic acid. Advantages, disadvantages and considerations of the method.
18. Solubility equilibrium. Solubility and solubility product. Factors affecting solubility. Conditional solubility product constant.
19. Gravimetry. Basic concepts. Advantages and disadvantages of the gravimetric analysis.
20. Precipitation titrations. Principles of precipitation titrations. Requirements to the analytical reaction. Argentometry. Titration curves. Mohr's method, Volhard's method and Fajan's method of titration.
21. Metal complexes. Composition of metal complexes. Ligands. Classification. Examples.
22. Stability of complexes. Stability constants.
23. Conditional metal–ligand formation constant.
24. EDTA-metal ion complexation equilibria
25. Complexometric titration. Principles. requirements for complexometric titrations. Titration curves in complexometric titrations. Metallochromic indicators.
26. Application of complexometric titration.

27. Oxidation-reduction equilibrium. Oxidation-reduction reactions. Strength of oxidizing and reducing agents. Electrode potential. Conditional electrode potential.
28. Redox titrations. Principles. Redox titration curves. Redox indicators.
29. Classification of oxidation-reduction titrations. Principles and applications of the methods: permanganometry; chromatometry: iodometry/iodimetry; bromatometry; nitritometry.
30. Classification of instrumental analysis. Calibration techniques: calibration curve method, standard additions method.
31. Electrochemical methods of analysis. Classification of electrochemical methods. Basic concepts: electrochemical cell; electrode; cell potential; electrode (electrochemical) reaction; polarization.
32. Conductimetry. Principles. Classification. Conductivity cell. Application of conductimetry.
33. Potentiometry. General principles and classification. Indicator and reference electrodes
34. Potentiometry. Direct potentiometry. pH metry and ionometry. Potentiometric titration. Principle of potentiometric titration. Application of potentiometry.
35. Voltammetry. Principles of voltammetry. Polarographic analysis: half-wave potential; diffusion current, qualitative and quantitative polarographic analysis. Modern polarographic methods.
36. Amperometric titration. Principles of amperometric titration. Conditions. titration curves in amperometry.
37. Coulometry. Faraday's Laws. Controlled potential coulometry. Coulometric titration. Application.
38. Classification of optical methods of analysis. Electromagnetic radiation - basic terms. Interaction of electromagnetic radiation with substance - absorption and emission. Electronic, vibrational and rotational spectrums.
39. Regions of the electromagnetic spectrum. Interaction of electromagnetic radiation with matter. Optical methods of analysis.
40. Principles of quantitative and qualitative optical methods. Calibration.
41. Atomic spectroscopy: atomic absorption, emission and mass spectrometry. Principles, analytical characterization and application of the methods.
42. UV-VIS molecular absorption spectrometry. Quantitative and qualitative analysis.
43. Infrared spectroscopy. Application.
44. Extraction. Classification. Distribution coefficient. Application.
45. Chromatography. Principle. Classification. Thin-layer chromatography (TLC). Application.
46. Liquid chromatography. Principle. Application.