Biochemical Techniques and Instrumentation

1. **Course number and name:** 020TBICS5 Biochemical Techniques and Instrumentation

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name of instructor:** -

4. **Instructional materials:**
   - PowerPoint slides

5. **Specific course information**
   a. **Catalog description:**
   General principle of chemical and physical quantification. Comparison of different methods for identification and quantification of biomolecules. Electrochemical principle of biomolecule quantification and separation. Electrochemical instruments. Spectrophotometric methods and instruments in quantitative analysis. Chromatographic principles of separation, identification, and quantitative analysis. Chromatographic instruments.

   b. **Prerequisites:** None

   c. **Required/ Selected Elective/Open Elective:** Selected Elective

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**

   By the end of this course, students will be able to:

   - Understand fundamental principles of chemical and physical quantification methods used in biochemical analysis.
   - Compare and evaluate various analytical techniques for the identification and quantification of biomolecules.
   - Explain the electrochemical basis of biomolecule detection and separation, including the theoretical principles of potentiometry, voltammetry, and amperometry.
   - Operate and interpret results from electrochemical instruments commonly used in biochemical laboratories.
   - Apply spectrophotometric methods (e.g., UV-Vis and fluorescence) to quantify biomolecules, and understand their instrumentation and calibration techniques.
   - Describe the principles of chromatographic separation, including partitioning, adsorption, and molecular interactions.
   - Analyze and interpret data from chromatographic methods such as TLC, GC, and HPLC for both qualitative and quantitative applications.
   - Select appropriate techniques based on sample type, analytical objective, and sensitivity requirements.
   - Integrate multiple analytical methods in designing experiments for biochemical research or diagnostic applications.

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b. PIs addressed by the course:

PI	7.1	7.2
Covered	x	x
Assessed	x	x

7. Brief list of topics to be covered

- Introduction to biomolecular quantification: chemical vs. physical methods
- Basic principles of chemical analysis and calibration techniques
- Overview of physical methods for identifying biomolecules
- Electrochemical principles: redox reactions and charge transfer in biomolecules
- Potentiometry, voltammetry, and amperometry for biomolecule analysis
- Electrochemical instrumentation and electrode types
- Spectrophotometry: Beer-Lambert law and its applications in biochemistry
- UV-Vis spectroscopy: principles, calibration curves, and sample analysis
- Fluorescence spectroscopy: principles and applications in biomolecule detection
- Spectrophotometric instrumentation and data interpretation
- Chromatography: principles of separation based on polarity and interaction
- Thin-layer chromatography (TLC) and its qualitative applications
- Gas chromatography (GC): principles, detectors, and applications
- High-performance liquid chromatography (HPLC): system components and quantification
- Chromatographic instrumentation: detectors, injectors, columns, and data analysis
- Comparison of methods: strengths, limitations, and selection criteria