

# **SABANCI UNIVERSITY**

Faculty of Eng. & Natural Sci.

BIO-335

Analytical Techniques

## **Instructor(s)**

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## **Course Content**

A general introduction to basic techniques used in characterization and separation of biological systems and molecules. Topics include microscopy, centrifugation, liquid chromatography methods, spectroscopy and electrophoresis. Lab sessions will give a chance to use these techniques individually.

## **Objectives**

To teach students the basic concepts of bioanalytical techniques in both, theory and practice, which are relevant to biologists and bioengineers but also students from different fields.

## **Recommended or required reading**

Textbooks:

Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8th Edition by Andreas Hofmann (Editor), Samuel Clokie (Editor), Publisher : Cambridge University Press; 8th edition (June 13, 2018), ISBN-10 : 1107162270

Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular Biology Friedrich Lottspeich (Editor), Joachim W. Engels (Editor)  
ISBN: 978-3-527-33919-8

Readings:

Course slides updated annually.

## **Course Outline**

Module 1: Microscopy  
Module 2: Electrophoresis Techniques  
Module 3: Centrifugation Techniques  
Module 4: Spectroscopic Techniques  
Module 5: PCR Techniques  
Module 6: Chromatography and Mass spectrometry

## **Learning Outcomes**

Students would be able to perform basic laboratory techniques.

Module 1 Microscopy: Students will have a deeper understanding of both, theory and application in the following topics:

Basic Concepts in Microscopy

Light microscopy

Fluorescence microscopy

Confocal Microscopy

Live-cell imaging and Sensor techniques

Module 2 Electrophoresis Techniques: Students will learn how to use Gel electrophoresis techniques for analysis of nucleic acids and proteins for both, diagnostic purposes and preparative purposes, which includes:

Basic Concepts in Electrophoresis

Horizontal and Vertical Electrophoresis

2D Gel Electrophoresis and Protein Detection Methods

Electrophoresis of Nucleic Acids

Module 3 Centrifugation Techniques:

Basic Concepts of Centrifugation Techniques

Types of Centrifuges and analytical ultracentrifugation techniques

Separation methods and preparative ultracentrifuges

Types of rotors

Module 4 Spectroscopic Techniques:

Introduction and basic concepts of Spectroscopic Techniques

UV-VIS Spectroscopy

Infrared and fluorescence spectroscopy

Circular dichroism (CD) spectroscopy

NMR Spectroscopy and X-ray crystallography

Atomic Spectroscopy and Mass spectroscopy

Module 5 PCR Techniques:

Principles of Polymerase Chain reaction

Preparative and Diagnostic PCR

DNA Sequencing methods

Sanger Sequencing, Next Generation Sequencing Methods

Module 6 Chromatography and Mass spectrometry:

Basic Principles of Chromatography

Thin layer chromatography

Liquid Chromatography

Gas Chromatography

Principles of MALDI-TOF

Electrospray Ionization Mass Spectrometry

## **Course Policies**

Class attendance is required. No more than 6 absents in the lecture class.

Lab sessions are obligatory. No more than 3 absents in lab class.

Each week in the lab sessions one quiz to the related topic.  
Protocols for the experiments should include a brief introduction, detailed methodology, presentation of the results and a short discussion.

<b>Percent</b>		
Lab	30%	
Final	40 %	
Midterm	15 %	1
Group Project	15 %	

## Lab

Practical Sessions will be in person from April 10th following the course plan given below

### BIO 335L - Analytical Techniques - Lab

Week 7	Lab Safety & Buffer Preparation
Week 8	Light microscopy
Week 9	Fluorescence microscopy
Week 10	Agarose Gel Electrophoresis
Week 11	Protein Isolation and SDS-PAGE
Week 12	Affinity & Size exclusion Chromatography
Week 13	Bradford Assay, OD, and Nanodrop
Week 14	Nanopore Sequencing