



**FACULTY OF HEALTH SCIENCES AND SPORTS**  
**BACHELOR OF SCIENCE IN BIOMEDICAL TECHNOLOGY**  
**(MEDICAL LABORATORY TECHNOLOGY)**  
**LEARNING MODULE OUTLINE**

Academic Year	2024 / 2025	Semester	1
Module Code	BSAC2101		
Learning Module	Analytical Chemistry		
Pre-requisite(s)	Nil		
Medium of Instruction	Chinese / English		
Credits	3	Contact Hours	45
Instructor	Veng Meng ,Richard Lo	Email	vmlo@mpu.edu.mo
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**MODULE DESCRIPTION**

This module is one of the fundamental subjects of biomedical program. There includes lecture hours and demonstration/experiment classes.

This module is designed to provide of basic principles and applications of current analytic chemistry topics.

**MODULE INTENDED LEARNING OUTCOMES (ILOS)**

On completion of this learning module, students will be able to:

M1.	Understand background knowledge of analytical chemistry
M2.	Understand the application of analytical chemistry
M3.	Understand the operation procedure of chemical analysis

These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

PILOs	M1	M2	M3
P1. To demonstrate understanding of a range of subjects, fields, principles and approaches relevant to medical laboratory technology	✓	✓	
P2. To demonstrate understanding of theories, analytical approaches and practices that underpin medical laboratory operations and management	✓	✓	✓
P3. To demonstrate understanding of major trends and issues related to medical laboratory technology	✓	✓	✓



P4. To apply professional knowledge and skills to analyse, interpret and solve problems, challenges and risks in medical laboratory practice	✓	✓	✓
P5. To critically appraise and interpret scientific and clinical literature and apply evidence-based practice	✓	✓	✓
P6. To acquire and apply research skills in medical laboratory technology	✓	✓	✓
P7. To demonstrate effective communication and teamwork skills			✓
P8. To maintain professional and ethical standards in medical laboratory practice and research		✓	✓

### **MODULE SCHEDULE, COVERAGE AND STUDY LOAD**

#### **Content**

<b>Theory</b>	<b>Contact Hours</b>
<b>1. Introduction to Analytical Chemistry</b>	<b>1 hr</b>
<b>2. Quantitative Analysis</b> 2.1 Gravimetric Analysis 2.2 Volumetric Analysis <ul style="list-style-type: none"><li>● Acid Base titration</li><li>● Precipitation titration</li><li>● Compleximetric titration.</li><li>● Reduction Oxidation titration</li><li>● Automation in Titrimetric methods</li></ul> 2.3 Automation in Titrimetric methods	<b>4 hrs</b>
<b>3. Separation methods</b> 3.1 Introduction to Chromatography <ul style="list-style-type: none"><li>● Thin Layer Chromatography</li><li>● Column Chromatography</li><li>● High Performance Liquid Chromatography</li><li>● Gas Chromatography</li></ul> 3.2 Gas Chromatography 3.3 High Performance Liquid Chromatography 3.4 Solid Phase Extraction (sample pretreatment) 3.5 Electrophoresis	<b>8 hrs</b>
<b>4. Electrochemical methods</b> 4.1 Potentionmetry <ul style="list-style-type: none"><li>● Principle of potentionmetry; Nernst Equation</li><li>● Structure of a potentionmetric cell.</li><li>● pH meter and applications</li></ul> 4.2 Voltammetry <ul style="list-style-type: none"><li>● Principle of voltammetry; Faraday's law of eletrolysis.</li><li>● Structure of voltammetric cell.</li></ul>	<b>3 hrs</b>



● Applications 4.3 Conductimetry	
5. <b>Spectroscopic Analysis</b> 5.1 Introduction to Spectroscopic Analysis 5.2 Basic theory 5.3 Spectrophotometer 5.4 Molecular Spectroscopy <ul style="list-style-type: none"><li>● Ultra Violet and Visible spectroscopy.</li><li>● Principles and applications of UV spectroscopy</li><li>● Fluorescence spectroscopy</li><li>● Scattering spectroscopy</li><li>● Infrared spectroscopy</li></ul> 5.5 Atomic spectroscopy <ul style="list-style-type: none"><li>● Atomic Absorption</li><li>● Atomic Emission</li><li>● Atomic Fluorescence</li><li>● Sample preparation for Atomic Spectroscopy</li></ul>	8 hrs
6. <b>Mass Spectroscopy</b> 6.1 Introduction to Mass Spectroscopy 6.2 Instrumentation 6.3 Applications	4 hrs
7. <b>Oral Presentation</b>	3 hrs
8. <b>Final Examination</b>	2 hrs
<b>Total</b>	<b>33 hrs</b>

Practice (Laboratory 3-5 students per group)	Duration
1. <b>Gravimetric Analysis of Chloride</b>	2 hrs
2. <b>Acid &amp; Base Standardization &amp; Volumetric Analysis of Antacid</b>	2 hrs
3. <b>Determination of the concentration of chlorine by Iodimetric titration</b>	1.5 hrs
4. <b>Water Hardness determination by Complex formation titrations</b>	1.5 hrs



5. Thin Layer Chromatography(TLC)	1 hr
6. Column Chromatography (demo)	1 hr
7. pH meter & Determination of Acid Dissociation Constant by titration	1 hr
8. UV Spectrophotometer	1 hr
9. Infrared Spectrophotometer & other chemical analysis instruments (demo)	1 hr
<b>Total</b>	<b>12 hrs</b>

## Teaching and Learning Activities

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

Teaching and Learning Activities	M1	M2	M3
T1. <i>Interactive lectures</i> <ul style="list-style-type: none"><li>■ Lectures: PowerPoint slides is presented and other supplementary materials provided if necessary</li><li>■ • Q &amp; As: Raising different questions can draw student interest to the lecture they learn.</li></ul>	✓	✓	✓
T2. <i>Laboratories</i> <ul style="list-style-type: none"><li>■ Students learn technical skills through laboratory operations</li></ul>		✓	✓
T3. <i>Assignments</i> <ul style="list-style-type: none"><li>■ In- depth knowledge learning can be attained by actively learning from students through their assignments</li></ul>	✓	✓	

## Alignment of MILOS with Teaching and Learning Activities

Activities	M1	M2	M3
Interactive lectures	✓	✓	✓
Laboratories		✓	✓
Assignments	✓	✓	

## Attendance

Attendance requirements are governed by the Academic Regulations Governing Bachelor's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.



## Assessment

In this learning module, students are required to complete the following assessment activities:

Assessment Activities	Weighting (%)	ILOs to be Assessed
A1. Examination	58%	M1, M2, M3
A2. Oral Presentation	8%	M1, M2
A3. Report	16%	M1, M2
A4. Laboratory Report	18%	M3

Any students scoring less than 35% of the total mark in the final examination will be given an “F” grade for the module even if the overall grade is 50% or higher.

The assessment will be conducted following the University’s Assessment Strategy (see [www.mpu.edu.mo/teaching\\_learning/en/assessment\\_strategy.php](http://www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php)). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

### MARKING SCHEME

Marks Ranges	Grade	Grade Point	Grade Definitions**
93–100	A	4.0	Excellent
88 – 92	A-	3.7	
83 – 87	B+	3.3	Very Good
78–82	B	3.0	Good
73 – 77	B-	2.7	
68–72	C+	2.3	Satisfactory
63–67	C	2.0	
58 – 62	C-	1.7	
53 – 57	D+	1.3	Passed
50 – 52	D	1.0	
0 – 49	F	0	Failed

#### Generic descriptions of each grade are given below:

**Excellent:** Strong evidence of original thinking; good organisation, capacity to analyse and systemise; superior grasps of subject matter; strong evidence of extensive knowledge base.

**Very Good:** Evidence of grasps of subject; strong evidence of critical capacity and analytical ability; good understanding of issues; evidence of familiarity with literature.

**Good:** Evidence of grasp of subject; some evidence of critical capacity and analytical ability; reasonable understanding of issues; evidence of familiarity with literature.



**Satisfactory:** Profiting from the study experience; understanding of the subject; ability to develop solutions to simple problems in the material.

**Pass:** Sufficient familiarity with the subject matter to enable the student to progress without repeating the learning module.

**Fail:** Little evidence of familiarity with the subject matter; weak in critical and analytical skills; limited, or irrelevant use of literature.

#### **REQUIRED READINGS**

1. Francis Rouessac and Annick Rouessac, 2022 Chemical Analysis (Modern Instrumentation Methods and Techniques). 3<sup>rd</sup> ed. John Wiley & Sons Ltd

#### **REFERENCES**

1. Douglas A. Skoog, Stanley R. Crouch, F. James Holler, F. James Holler, Stanley R. Crouch, Belmont, CA, 2006, Principles of Instrumental Analysis, 6<sup>th</sup> ed. Thomson-Brooks/Cole.

#### **STUDENT FEEDBACK**

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

#### **ACADEMIC INTEGRITY**

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at [www.mpu.edu.mo/student\\_handbook/](http://www.mpu.edu.mo/student_handbook/).