FACULTY OF HEALTH SCIENCES AND SPORTS

BACHELOR OF SCIENCE IN BIOMEDICAL TECHNOLOGY (PHARMACY TECHNOLOGY)

LEARNING MODULE OUTLINE

Academic Year	2023/2024	Semester	2
Module Code	BSPA2102		
Learning Module	Pharmaceutical Analysis		
Pre-requisite(s)	BSAC2101		
Medium of Instruction	Chinese / English		
Credits	4	Contact Hours	60
Instructor	Dr. Tao Yi, Aaron	Email	yitao@mpu.edu.mo
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MODULE DESCRIPTION

This course aims to enable students to apply the concepts of pharmaceutical analysis in their pharmacy practice. This course has 30-hour lectures, 20-hour laboratory sessions, 6-hour active learning and presentation, 4-hour examination and 60 teaching hours in total.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

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

M1.	Demonstrate an understanding of the basic concepts of pharmaceutical analysis.
M2.	Describe theoretical backgrounds of the basic techniques in pharmaceutical analysis, including titration, UV spectroscopy, FTIR spectroscopy, GC / GC-MS, HPLC, TLC, extraction methods, NMR, Atomic emission spectrophotometry, Atomic absorption spectrophotometry, Fluorescence spectrophotometry, and Raman spectroscopy.
M3.	Apply the aforementioned basic techniques in pharmaceutical analysis into real pharmacy practice.
M4.	Perform the aforementioned basic techniques in pharmaceutical analysis according to pharmacopoeial specifications.
M5.	Develop SOP for the aforementioned basic techniques in pharmaceutical analysis.
M6.	Communicate scientific concepts effectively through oral presentations, demonstrating comprehension of pharmaceutical analysis principles.

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

PILOs	M1	M2	M3	M4	M5	M6
P1. To demonstrate understanding of a range of subjects, fields, principles and approaches relevant to pharmacy technology	✓	✓	✓	✓	✓	✓
P2. To demonstrate understanding of theories, analytical approaches and practices that underpin pharmacy operations and management	✓	✓	✓	✓	✓	✓
P3. To demonstrate understanding of major trends and issues related to pharmacy technology	✓	✓	✓	✓		✓
P4. To apply professional knowledge and skills to analyse, interpret and solve problems, challenges and risks in pharmacy practice	✓		✓	✓	✓	
P5. To critically appraise and interpret scientific and clinical literature and apply evidence-based practice	✓			✓	✓	✓
P6. To acquire and apply research skills in pharmacy technology		✓	✓	✓	✓	✓
P7. To demonstrate effective communication and teamwork skills						✓
P8. To maintain professional and ethical standards in pharmacy practice and research	✓	✓	✓	✓	✓	✓

MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours

1	1. Introduction to pharmaceutical analysis
	   1.1 Introduction
	   1.2 Control of errors in analysis
	   1.3 Accuracy and precision
	   1.4 Validation of analytical procedures
	   1.5 Standard operating procedure (SOP)
	   1.6 Compound random errors
	   1.7 Reporting of results
	   1.8 Other terms used in the control of analytical procedures
	   1.9 Basic calculations in pharmaceutical analysis
		4

2	2. Titration in pharmaceutical analysis
	   2.1 Direct acid/base titrations in the aqueous phase
	   2.2 Indirect titrations in the aqueous phase
	   2.3 Non-aqueous titrations
	   2.4 Redox titrations
	   2.5 Iodometric titrations
	   2.6 SOP write-up in the assay for potassium permanganate according to BP2002
	3. UV spectroscopy in pharmaceutical analysis
	   3.1 Factors governing absorption of radiation in the UV/visible region
	   3.2 Beer-Lambert law
	   3.3 Instrumentation
	   3.4 UV spectra of some representative drug molecules
	   3.5 Use of UV/visible spectrophotometry to determine pKa values
	   3.6 Applications of UV/visible spectroscopy to pharmaceutical quantitative analysis
	   3.7 Difference spectrophotometry
	   3.8 Applications of UV/visible spectroscopy in preformulation and formulation
	   3.9 SOP write-up in the assay for Aspirin tablet according to BP2002
		4

Week	Content Coverage	Contact Hours

3	4. FTIR spectroscopy in pharmaceutical analysis
	    4.1 Introduction
	    4.2 Band Intensity in IR
	    4.3 Instrumentation
	    4.4 Sample preparation
	    4.5 Application of IR spectrophotometry in structure elucidation
	    4.6 IR spectrophotometry as a fingerprint technique
	    4.7 Infrared spectrophotometry as a method for identifying polymorphs
	    4.8 Peak assignments for 6 chemicals
		4

4	5. Practice 1: Assay for potassium permanganate according to BP2002	4
5	6. Practice 2: Assay for Aspirin tablet using two methods 7. Practice 3: Pharmaceutical Application of Fourier-Transform Infrared (FTIR) Spectroscopy	4
8	8. Midterm 9. Extraction methods in pharmaceutical analysis 9.1 Solvent extraction methods	4

9	9.2 Microdialysis extraction
	    9.3 Solid-phase extraction (SPE)
	
	10. Thin-layer chromatography
	    10.1 Overview
	    10.2 Thin Layer Chromatography (TLC)
	    10.3 High Performance Thin Layer Chromatogarphy (HPTLC)
		4

10	11. GC and GC-MS in pharmaceutical analysis
	    11.1 Principles
	    11.2 Instrumentation
	    11.3 GC – Derivatization
	    11.4 Applications
		4

11	12. HPLC
	    12.1 Overview
	    12.2 Principles and instrumentation
		4

12	12.3 Applications	4
13	13. Practice 4: Extraction and TLC in pharmaceutical analysis 14. Practice 5: Assay of cinnamaldehyde in cinnamon bark oil according to BP2013	4
15	15. Practice 6: HPLC in pharmaceutical analysis	4
16	Practice 6: HPLC in pharmaceutical analysis	4

17	16. Active learning and presentation
	    16.1 Atomic emission spectrophotometry
	    16.2 Atomic absorption spectrophotometry
	    16.3 Fluorescence spectrophotometry
	    16.4 Raman spectroscopy
	    16.5 Nuclear magnetic resonance spectroscopy
		6

18	17. Final	2

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	M4	M5	M6
T1. Lectures with case studies and real-life examples	✓	✓	✓	✓	✓	
T2. Laboratory Practice	✓	✓	✓	✓	✓	✓
T3. Group discussion and presentations	✓	✓	✓	✓	✓	✓

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing [Doctoral/Master's/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. Presentation	5	M4, M5, M6
A2. Group discussions	5	M1, M2, M3, M4, M5, M6
A3. Laboratory Practice	5×6=30	M1, M2, M3, M4, M5, M6
A4. Midterm	30	M1, M2, M3, M4, M5
A5. Final exam	30	M1, M2, M3, M4, M5

This learning module is graded on a 100 point scale, with 100 being the highest possible score and 50 being the passing score.

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). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

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MARKING SCHEME

Assessment Activities	Assessment Criteria	Mark Ranges				
		88-100	73-87	58-72	50-57	<50
A1. Presentation	Demonstrate the ability to apply pharmaceutical analysis knowledge to analyse and interpret practical cases and communicate scientific concepts effectively through oral presentations	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A2. Group discussions	Demonstrate the ability to apply pharmaceutical analysis knowledge to analyse and interpret practical cases and communicate scientific concepts effectively through oral discussions	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A3. Laboratory Practice	Demonstrate the ability to demonstrate understanding of theories, analytical approaches and practices, and apply the basic techniques in pharmaceutical analysis practice	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A4. Midterm	Demonstrate the ability to understand, identify, and apply appropriate pharmaceutical analysis concepts, knowledge, and methods	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A5. Final exam	Demonstrate the ability to understand, identify, and apply appropriate pharmaceutical analysis concepts, knowledge, and methods	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels

REQUIRED READINGS

Watson DG. 2021, Pharmaceutical analysis: a textbook for pharmacy students and pharmaceutical chemists. 5th edition. London: Churchill Livingstone.

REFERENCES

Lindon, John C ; Tranter, George E ; Koppenaal, David. 2017, Encyclopedia of spectroscopy and spectrometry.

Kidlington, Oxford: Academic Press is an imprint of Elsevier, Third edition.

Taijun Hang. 2016, Pharmaceutical analysis. 8th edition. Beijing: People's Medical Publishing House.

Harry G Brittain. 2001, Analytical profiles of drug substances and excipients. Academic Press.

Dengkui An. 2001, Selected topics on modern pharmaceutical analysis. China Medical Science and Technology Press.

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/.