

Department of Medical Physics – MATLAB Course – Theoretical Component Second Semester 2025

Course Description - Theoretical Component

College: Al-Zahrawi University College - Department of Medical Physics

Course Name: MATLAB

Units: 5

Theoretical Hours: 2 hours per week

Language of Instruction: English

Instructor: Asst. Lecturer Hussein Abdulali Al-Saadi

General Objectives

The theoretical part of this course aims to equip medical physics students with essential programming concepts in MATLAB. By the end of the course, students will be able to:

- Understand the structure and key features of the MATLAB environment.
- Define and use basic data types such as scalars, vectors, matrices, symbolic expressions, and character arrays.
- Analyze and manipulate numerical and symbolic data using MATLAB's built-in functions.
- Apply conditional logic using `if`, `elseif`, `else`, and `switch` statements.
- Understand how to control repetition using loops (`for`, `while`) for iterative processes.
- Use input and output commands to manage data interaction within a script.
- Interpret and write basic MATLAB code relevant to medical physics scenarios, such as data analysis, simulations, and visualization.

This theoretical foundation prepares students to apply MATLAB in solving real-world problems in medical and scientific research.

Weekly Study Plan (Theoretical Lectures)

Week	Topic
Week 1	Introduction to MATLAB: Overview, importance, and applications in medical physics
Week 2	MATLAB Interface: Desktop layout, Command Window, Editor, Workspace
Week 3	Variables and Basic Data Types: Scalars, Vectors, Matrices
Week 4	Symbolic Data and Character Arrays
Week 5	Midterm Exam (Theoretical)
Week 6	Working with Vectors: Creation, access, and basic operations
Week 7	Working with Matrices: Input, indexing, advanced operations, useful functions
Week 8	Midterm Exam (Practical)
Week 9	Input and Output Commands: <code>input</code> , <code>disp</code> , <code>display</code>
Week 10	Conditional Statements: <code>if</code> , <code>elseif</code> , <code>else</code>
Week 11	<code>switch-case</code> Structure and Comparison with <code>if</code> Statements
Week 12	Loops in MATLAB: <code>for</code> and <code>while</code> – structure, use cases, and differences
Week 13	Plotting in MATLAB: <code>plot()</code> function, titles, axes labels, and grid
Week 14	Scripts in MATLAB: Creating <code>.m</code> files, script vs. function, how to run
Week 15	Final Exam (Theoretical)

Module Evaluation

The final grade for this course is based on a total of **100 marks**, distributed as follows:

A. Coursework (50 Marks)

Component	Frequency	Mark per Attempt	Weight
Quizzes	3 times	10 marks	10 marks
Reports	3 times	25 marks	10 marks
Home Assignments	3 times	25 marks	10 marks
Laboratory Assessment	1 time	25 marks	5 marks
In-Class Participation (College Tasks)	2 times	10 marks	5 marks
Midterm Exam (Theoretical)	1 time	10 marks	10 marks

Subtotal: 50 Marks

B. Final Examination (50 Marks)

Component	Weight
Final Practical Exam	20 marks
Final Theoretical Exam	30 marks

Subtotal: 50 Marks

Recommended References

1. **Chapman, Stephen J.**
MATLAB for Engineers
McGraw-Hill Education, 5th Edition, 2016.
→ A comprehensive introduction to MATLAB with practical engineering examples.
2. **Attaway, Stormy.**
MATLAB: A Practical Introduction to Programming and Problem Solving
Elsevier, 5th Edition, 2020.
→ Ideal for beginners with step-by-step explanations and hands-on exercises.
3. **Amos Gilat.**
MATLAB: An Introduction with Applications
Wiley, 6th Edition, 2017.
→ Offers clear explanations with scientific and mathematical applications.
4. **MathWorks Documentation**
<https://www.mathworks.com/help/matlab>
→ Official online resource for all MATLAB functions and examples.

Relation to Other Courses

This course supports and complements several other subjects within the Medical Physics program. It provides foundational computational and programming skills that are essential for:

- **Medical Imaging and Radiation Physics:** MATLAB is used to process and analyze imaging data, simulate radiation dose distributions, and visualize physical models.
- **Biophysics and Mathematical Modeling:** Students apply MATLAB to simulate biological systems and solve differential equations used in medical research.
- **Instrumentation and Laboratory Techniques:** MATLAB helps in processing signals from medical devices and analyzing experimental data.
- **Research Methodology:** The course enhances students' abilities to handle data, automate analysis, and develop custom tools for scientific investigation.

By integrating MATLAB with these courses, students gain practical skills for solving real-world problems in medical physics.