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The primary focus of Dr. Usmani's research and teaching is to explore the transformative potential of emerging computer based technologies, including Machine Learning, Artificial Intelligence, and Quantum Computing. His work emphasizes the practical application of these technologies across diverse disciplines such as agriculture, pharmaceuticals, commerce, physics, chemistry, education, and healthcare. Furthermore, he is committed to fostering innovation and equipping students with the knowledge and skills required to become self-reliant and professionally competent upon completing their academic programs.



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PYTHON

FOR PHARMACEUTICAL SCIENCES

A BEGINNER'S GUIDE



By

DR. M. A. A. USMANI

Ph.D.

Computer Application – Machine Learning

&

DR. IRFAN AZIZ

Ph.D.

Pharmaceutical Sciences

As per B. Pharm Syllabus 2026 of PCI and NEP 2020, Code: BP101T

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Python for Pharmaceutical Sciences

A Beginner's Guide

**As per B. Pharm Syllabus 2026 of
PCI and NEP 2020, Code: BP101T**

***From Variables to Visualizations, with
Real Pharmacy Applications
For B. Pharm Students***

Dr. M. A. A. Usmani (Ph.D.: Computer Application – Machine Learning)

And

Dr. Irfan Aziz (Ph.D.: Pharmaceutical Sciences)

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Preface

Picture this. You are a third-year pharmacy student, and your professor has just handed you a spreadsheet with 800 rows of patient data. It contains drug concentrations, time points, dosage details, and a column of adverse event codes that seems to go on forever. You have been asked to find patterns, calculate averages, and produce a graph by next week. You open the file, stare at the screen, and wonder: where on earth do I even begin?

If that scenario feels familiar, this book was written for you.

Pharmaceutical sciences are changing fast. Drug discovery pipelines now generate enormous amounts of data. Clinical trials produce complex datasets that must be cleaned, analysed, and visualised. Pharmacokinetic studies require calculations that go well beyond what a calculator can handle efficiently. Across all of these areas, one tool has emerged as the language of choice for scientists who work with data: Python. It is free, readable, powerful, and increasingly expected in modern pharmacy and healthcare settings.

And yet, for students who have spent their academic lives studying drug mechanisms, anatomy, and pharmacology, the idea of learning to code can feel genuinely intimidating. Programming textbooks are often written by computer scientists for computer scientists. They talk about algorithms and data structures in the abstract, using examples that have nothing to do with medicine or pharmacy. You are left trying to figure out how any of it connects to what you actually need to do.

This book takes a different approach. Every concept is taught through a pharmaceutical lens. When we introduce variables, we use drug concentrations and patient data. When we explain loops, we calculate plasma concentration at each hour after administration. When we visualise data, we plot concentration-time curves that you have already encountered in your pharmacokinetics lectures.

Python is never presented as an end in itself. It is presented as a practical tool that makes your work as a future pharmacist or pharmaceutical scientist faster, cleaner, and more credible.

The course this book accompanies, Python for Pharmaceutical Sciences, is designed to give you a solid foundation in exactly five areas: the basics of Python, control structures and functions, data structures and file handling, data analysis with Pandas, and data visualisation with Matplotlib. Each chapter of this book maps to one of those areas. Nothing has been added to confuse you and nothing important has been left out.

You do not need any prior programming experience to use this book. You do not need a mathematics or engineering background. What you do need is a willingness to type code, make mistakes, figure out what went wrong, and try again. That process, more than anything else, is how programming is learned. This book will walk alongside you through every step of it.

By the time you reach the last chapter, you will be able to load a real pharmaceutical dataset, clean it, analyse it, and produce a publication-ready graph. That is not a small thing. It is a skill that will serve you in your studies, in your research projects, and in your career. Welcome to the journey.

How to Use This Book

Every chapter in this book follows the same structure, so you always know what to expect. Each chapter opens with clear learning objectives tied to the course outcomes for Python for Pharmaceutical Sciences. The concept is then explained in plain language, usually with a pharmaceutical analogy, before moving into code examples with line-by-line commentary. A full pharmaceutical case study shows you how the concept works in a realistic setting. The chapter closes with graded practice exercises.

Icons Used in This Book

Four icons appear throughout the chapters to guide your attention:

- **[CODE]** A complete code block for you to type and run in Jupyter Notebook. Always type it yourself rather than copying and pasting. The act of typing helps you notice details, builds muscle memory, and makes errors easier to spot and remember.
- **[TRY IT]** A short, quick exercise placed right after a concept is introduced. These are meant to be attempted immediately, before moving on. They take only a few minutes and confirm that the idea has landed.
- **[CASE STUDY]** A realistic pharmaceutical application of the concept you just learned. These appear at the end of each major section and show you how the code connects to actual pharmacy practice.
- **[WATCH OUT]** A common beginner mistake, shown clearly so you can recognise and avoid it. These are drawn from real errors that students make when encountering a concept for the first time.

A Note on Typing Code

It is tempting to copy and paste code blocks, especially when they are long. Please resist the temptation. Typing code yourself forces you to read every character carefully. You will notice indentation, colons, parentheses, and quotation marks in a way that passive reading never achieves. Most importantly, when something does not work, you will have a much clearer sense of where to look. The small investment of time pays back many times over.

Exercise Difficulty Levels

Exercises at the end of each chapter are labelled by difficulty:

- **Easy:** straightforward application of what was just taught. Ideal for building confidence.
- **Medium:** requires combining two or more ideas from the chapter. A good target for most students.
- **Challenge:** open-ended or more complex. Designed for students who want to go further.

Answers to all exercises are provided in Appendix D at the back of the book. Try each exercise independently before checking the answers.

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