10-Days Online Interdisciplinary Workshop in R

Physics, Chemistry, Mathematics & Management

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Note: This course is structured to provide a comprehensive introduction to R programming with domain-specific applications. It is divided into three modules for progressive learning.

Module 1: R Fundamentals and Data Structures

28/07/2025 Day 1: Getting Started with R and RStudio

Topics Covered:

- Installing R and RStudio
- RStudio interface tour (Console, Script, Environment, Plots)
- Basic operations and variables
- Data types: vectors and matrices
- **Application:** Physics – Storing experimental values

Learning Objective: Understand the R environment and perform basic data operations.

29/07/2025 Day 2: Exploring Data Structures and Importing Data

Topics Covered:

- Lists, data frames, factors
- Importing/exporting data (CSV, Excel)
- Basic data manipulation
- **Application:** Management – Student database handling

Learning Objective: Work with essential data structures and data import/export operations.

Module 2: Data Visualization and Statistical Thinking

30/07/2025 Day 3: Data Visualization with Base R and ggplot2

Topics Covered:

- Base R plotting
- Introduction to ggplot2
- Scatter plots, line graphs, bar charts
- **Application:** Chemistry – Reaction kinetics plots, FT IR data

Learning Objective: Create and interpret basic visualizations in R.

31/07/2025 Day 4: Basic Statistical

Analysis in R Topics Covered:

- Descriptive statistics
- Hypothesis testing: t-tests, ANOVA
- Correlation analysis
- **Application:** Mathematics – Probability distributions; Chemistry – Chemical reagent analysis

Learning Objective: Conduct and interpret basic statistical tests in R.

01/08/2025 Day 5: Data Wrangling with dplyr

Topics Covered:

- Filter, select, mutate, summarize
- Using pipes (%>%)
- Grouping operations
- **Application:** Management – Sales data analysis

Learning Objective: Manipulate and summarize datasets efficiently.

Module 3: Advanced Packages and Reporting

04/08/2025 Day 6: Exploring Domain-Specific

Packages – Part I Topics Covered:

- pracma for numerical analysis (Physics)
- ChemmineR for cheminformatics (Chemistry)

Learning Objective: Use specialized packages for solving domain-specific problems.

05/08/2025 Day 7: Exploring Domain-Specific Packages

– Part II Topics Covered:

- forecast for time series analysis (Mathematics)
- quantmod for financial data analysis (Management)

Learning Objective: Analyze time series and financial data using R packages.

06/08/2025 Day 8: Writing Functions and Using

Loops Topics Covered:

- Writing custom functions
- For/while loops
- apply family functions
- **Application:** All domains – Automating repetitive tasks

Learning Objective: Write modular code using functions and control structures.

07/0/2025 Day 9: Report Generation with R

Markdown Topics Covered:

- Creating dynamic documents
- Integrating code, results, and text
- Exporting to HTML and PDF
- **Application:** Thesis/research reporting

Learning Objective: Generate professional and reproducible reports.

08/08/2025 Day 10: Final Project – Domain-Specific

Applications Project Options:

- Physics: Analyzing pendulum experiment data
- Chemistry: Chemical concentration analysis
- Mathematics: Fibonacci sequence or time series modeling
- Management: Stock market trend analysis

Learning Objective: Apply acquired skills to a real-world domain-specific project.

Note: Applications span across disciplines. Participants are encouraged to select domains relevant to their academic or professional background.