



**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani**  
**Pilani Campus**  
**AUGS/ AGSR Division**

**FIRST SEMESTER 2021-22**  
**COURSE HANDOUT**

**Date: 22.08.2021**

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

**Course No** : MPBA G507  
**Course Title** : Programming for Analytics  
**Instructor-in-Charge** : Revendranath T  
**Tutorial/Practical Instructors:**

**1. Course Description:**

To apply programming skills to analyse data, apply transformation techniques, create visualisations, and web-based (Shiny applications). The course imparts essential skills of R-programming, and Python for data analysis, data transformation, and visualization. In addition, students will be prepared to manage code through version control tool (GitHub), and develop web-applications using Shiny App. No pre-requisites for the course.

**2. Scope and Objective of the Course:**

Primary languages for the course are R and Python are covered equally up to the lab module number 14 (lab topic number 18; refer to the course plan). Web application development is an essential skill in business analytics, and is taught using Shiny App (R Programming). Students will be taught R, followed by Python. Enthusiastic students are encouraged to explore Julia Language for data sciences (Supporting reading materials and code may be provided).

**3. Text Books:**

- **T1:** R for Data Science by Hadley Wickham (Free online copy available at <https://r4ds.had.co.nz/>)
- **T2:** R Cookbook by James (JD) Long, & Paul Teetor (Free online copy available at <https://rc2e.com/>)
- **T3:** Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning by Chris Albon
- **T4:** Mastering Shiny: Build Interactive Apps, Reports, and Dashboards Powered by R by Hadley Wickham

**4. Reference Books:**

- Data Science Tutorials in Julia: <https://alan-turing-institute.github.io/DataScienceTutorials.jl/>

**5. Course Plan:**

Session No.	Topic	Learning outcomes
1	Programming for Analytics	To understand the utility of R, Python & Julia programming languages to create analytics applications that solve business problems.
2-3	Data types, and data structures	To apply (a) the basics of variables, data types, conditional & iterative statements, and functions; (b) data structures to build or analyse different types of datasets using R and Python programming.



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3	Packages	To apply existing packages, and develop new packages using R and Python.
4-5	Data wrangling techniques	To apply data wrangling techniques on datasets using R and Python
6	Data visualisation	To apply visualisation data using ggplot2 package (in R) and seaborn package (in Python).
7	Operations on categorical data	To apply data wrangling operations on nominal data and ordinal data attributes in datasets using R and Python.
8	Operations on time-series data	To apply data reading, writing, wrangling operations on time-series datasets using R and Python.
9	Operations on images	To apply data reading, writing, wrangling operations on images datasets using R and Python.
10	Operations on text data	To apply operations on text data such as characters, strings, sentences, paragraphs, documents, etc., and prepare the data for further analysis
11	Web applications development using Shiny App (R-programming)	To create web applications using Shiny App (in R).

Lab Module No.	Lab Session	Learning outcomes
1-2	Installation of R Studio, Python, related packages on computer/server, and basics of version control using Github.	To apply installation of software for R programming and Python language, R Studio (IDE), and Github. To remember how to connect RStudio with Github, and apply concepts of version control of code.
3	Basics: (1) variables & data types, (2) operators, (3) conditional statements, (4) iteration statements, (5) functions, (6) Objects and classes for Python	To apply the basics of variables, data types, conditional & iterative statements, and functions using R and Python programming.
4	(7) Data Structures: vectors, matrices, lists, tuples, dictionaries, dataframes,	To apply relevant data structures to build or analyse different types of datasets using R and Python.
5-6	(8) Packages: using existing packages and creating new packages (9) Read/Write Data: from/to CSV, MS Excel, JSON & SQL databases	(a) To apply existing packages, and develop new packages using R and Python. (b) To apply packages to read/write data from/to different data sources using R and Python.
7-8	(10) Data wrangling part -1: describing, summarizing, manipulating, and handling missing values of data in dataframes.	To apply data wrangling techniques on datasets using R and Python
9-10	(11) Data wrangling part -2: perform operation such as delete values, find unique values, drop duplicate values, grouping, and	



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	performing loop operations over columns or rows; merging dataframes.	
11-12	(12) Operations on categorical data (13) Operations on time-series data	(a) To apply data wrangling operations on nominal data and ordinal data attributes in datasets using R and Python. (b) To apply data reading, writing, wrangling operations on time-series datasets using R and Python.
13-14	(14) Operations on text data (15) Operations on web scraping	(a) To apply data reading, writing, wrangling operations on text datasets using R and Python. (b) To apply web scraping and gather data using R and Python.
15-16	(16) Operations on images (17) Data visualisation	(a) To apply data reading, writing, wrangling operations on images datasets using R and Python. (b) To apply visualisation data using ggplot2 package (in R) and seaborn package (in Python).
17-18	(18) Mathematics essentials for data sciences	To apply mathematical operations (linear algebra) on datasets using R and Python.
19-22	(19) Web applications development using Shiny App (R-programming)	To create web applications using Shiny App (in R).

**6. Evaluation Scheme:** Evaluation components assess a range of learning outcomes: basic comprehension of the topics taught, application of different assignments in the lab skills learnt, and ability to solve new data problems. The proposed evaluation scheme is given in the table below:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Surprise Quizzes (MCQs)	10 Min.	20	Modules 1 to 7	Open Book
Lab Performance		50		Each lab performance will be graded.
Comprehensive Examination	3 h	30	Modules 1 to 14	Open Book

**7. Chamber Consultation Hour:** 5:00-6:30pm, Friday

**8. Notices:** Notices will be displayed on Nalanda/Google Classroom.

**9. Make-up Policy:** No make ups will be granted for Daily Labs. Genuine cases such as hospitalization, (upon production of the relevant documents as records/ proof) will be considered upon discussion with individuals/ team for any make ups for the final Exam.

**10. Note (if any):**

**Instructor-in-charge**  
**Course No. MPBA G507**