



**B.Sc. (Honours) Statistics Degree Program/ B.Sc. Degree Program**  
**Faculty of Applied Sciences**  
**University of Sri Jayewardenepura**

<b>Course Title</b>	<b>Programming and Data Analysis with R</b>
<b>Course Code</b>	<b>STA 326 2.0/ ASP 454 2.0/ CSC 381 2.0</b>
<b>Credit Value</b>	02
<b>Status</b>	Core for BSc (Honours) Statistics students/ Optional for others
<b>Year/ Level</b>	Year 3
<b>Semester</b>	1
<b>Theory: Practical: Independent Learning</b>	30 : 00 : 70
<b>Other: Pre-requisite course/s</b>	STA 114 2.0 Probability and Distribution Theory I, STA 123 2.0 Probability and Distribution Theory II, STA 124 1.5 Data Analysis I, STA 213 2.0 Statistical Inference, STA 226 1.5 Data Analysis II

**Aims of the Course:**

- To introduce how to program efficiently in R.
- To provide an in-depth and more advanced coverage of data wrangling, visualisation and analysis methods in the R programming environment.

**Intended Learning Outcomes:**

*On the successful completion of this course, the student should be able to:*

1. Use data classes, object attributes, data structures in R
2. Write user-defined functions in R to solve a given problem.
3. Apply control structures in R to control the flow of the program.
4. Apply the principles of tidyverse programming and organise complex, messy, data into the most convenient form for analysis or reporting.
5. Select effective visualisation and modelling approaches to understand relationships between variables, and make decisions with data.
6. Interpret the results of analysis and communicate these to a broad audience.

**Course Content:**

1. R programming basics: Objects in R, Data types, Operations, Installing packages, Control structures, Piping
2. Writing functions in R
3. Programming and Data analysis with the tidyverse
  - 3.1. Data import and export
  - 3.2. Data wrangling: Tidy data principles, Reshaping data into tidy form, Data transformation
  - 3.3. Data visualization: The grammar of graphics
  - 3.4. Statistical modelling and inference
  - 3.5. Communication: Dynamic reproducible reporting

**Scope and Schedule of Teaching - Learning Activities:**

Topic No.	Topic/Sub Topic	No. of Hrs			Teaching Method	Assessment Criteria	ILO Alignment
		T	P	IL			
1	Introduction to R and R studio and R Programming basics	2	0	4	Lecture/ R programming practice questions		1
2	Data structures in R	2	0	4	Lecture		1
3	Functions in R	2	0	4	Lecture/ Flipped classroom/ R programming practice questions		1
4	Writing functions in R	2	0	4	Lecture/ R programming practice questions		2
5	Control structures	2	0	4	Lecture/ R programming practice questions		3
6	Introduction to the tidyverse data science workflow: Data import and export	2	0	5	Lecture/ R programming practice questions		4
7	Reproducible reporting with R Markdown	2	0	5	Lecture/ R programming practice questions/ Virtual Discussion Forum		4, 6
8	Data wrangling: Reshaping data	2	0	5	Lecture/ Mid-semester examination	30% of Final Marks	4
9	Data wrangling: Data manipulation	2	0	5	Lecture/ R programming practice questions		4
10	The grammar of graphics	2	0	5	Lecture/ R programming practice questions		4, 5, 6
11	Regression Analysis with R	2	0	5	Lecture/ R programming practice questions		4, 5, 6
12	The inverse transform method and The method of Monte Carlo	2	0	5	Lecture/ R programming practice questions		5
13	Hypothesis testing	2	0	5	Lecture/ R programming practice questions		5, 6
14	Functionals	2	0	5	Lecture/ R programming practice questions		4, 5
15	Revision and ways to continue learning R no matter what you choose to be your next step	2	0	5	Lecture/ R programming journal article		1, 2, 3, 4, 5, 6
	Total	30	00	70			

### Linking Program Outcomes with ILOs:

#### Program Outcomes: B.Sc. Honours degree

1. Demonstrate competency in theoretical knowledge and practical and/or technical skills in the respective field of specialization (statistics).
2. Communicate efficiently and effectively in the respective field of specialization using written, oral, visual and/or electronic forms.
3. Facilitate and participate as an empathetic and emotionally intelligent team player with leadership qualities, in a group, diverse team or organization.
4. Apply subject-specific knowledge and skills creatively to solve real-world problems by making context-specific operational decisions while adapting to changing environments.
5. Integrate creativity, innovation, and entrepreneurial and managerial proficiencies to build values.
6. Implement subject-based solutions in keeping with ethical, societal and environmental norms and need for sustainable development.
7. Secure life goals through lifelong learning with the aim of scholarly advancement and/or strengthening professional skills, and ensuring the betterment of the community.

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
ILO 1	***	*		*			
ILO 2	***	***		**			
ILO 3	**	**			**		
ILO 4	***	***			**		*
ILO 5	***	***	***	***	***	***	**
ILO 6	***	***	***	***	***	***	***

\*\*\* - Strongly linked; \*\* - Medium linked; \* - Weekly linked

#### Program Outcomes: B.Sc. General degree

1. Demonstrate competency in theoretical knowledge and practical and/or technical skills in respective subject areas (statistics).
2. Communicate efficiently and effectively in the respective subject areas using written, oral, visual and/or electronic forms.
3. Facilitate, and participate as an empathetic and emotionally intelligent team player with leadership qualities, in a group, diverse team or organization.
4. Apply subject based knowledge and skills creatively in making appropriate judgements in changing situations.
5. Integrate creativity and innovation to achieve entrepreneurial competencies.
6. Implement solutions in keeping with ethical, societal and environmental norms and need for sustainable development.
7. Secure life goals through lifelong learning with the aim of strengthening professional skills, and ensuring the betterment of the community.

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
ILO 1	***	*		*			
ILO 2	***	***		**			
ILO 3	**	**			**		
ILO 4	***	***			**		*
ILO 5	***	***	***	***	***	***	**
ILO 6	***	***	***	***	***	***	***

\*\*\* - Strongly linked; \*\* - Medium linked; \* - Weekly linked

#### Mode of Assessment:

##### Formative Assessment (FA):

Mid Semester Examination = 30% of total marks

##### Summative Assessment (SA):

End Semester Examination: 2-hour paper covering MCQs and or Short Questions, Structured Essay-type questions and Essay-type question = 70% of total marks

#### References:

- Talagala, T. S. (2024). Course website: STA 326 2.0 Programming and Data Analysis with R, *Course website*. <https://thiyanagt.github.io/rprogramming/>
- Talagala, T. S. (2024). *Programming and Data Analysis with R*. Available online at <https://thiyanagt.github.io/rbook/>
- Wickham, H., & Grolemund, G. (2019). *R for data science: import, tidy, transform, visualize, and model data*. O'Reilly Media, Inc. Retrieved from <https://r4ds.had.co.nz/>
- Grolemund, G. (2014). *Hands-on programming with R: write your own functions and simulations*. O'Reilly Media, Inc. Retrieved from <https://rstudio-education.github.io/hopr/>